TROPICAL DISEASES BUREAU.

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DISEASES DUE TO PROTOZOAN PARASITES.

HORNBY (H. E.). **Some Notes on the Use of Tartar Emetic in the Treatment of Domestic Animals affected with Trypanosomiasis.**—*Vet. Jl.* 1919. Mar. Vol. 75. No. 3. pp. 89–103.

In this paper Hornby first gives a good summary of the history of the employment of tartar emetic in the treatment of protozoan diseases; he then summarises what appears to be very extensive experience relating to the use of the drug in the treatment of fly-struck animals from 1913 to 1918 in Northern Rhodesia and at the seat of military operations against the German Forces in East Africa during the last three years.

A safe single dose for the horse, mule, ox and even donkey is one gramme and for sheep and goats 0·1 gramme, administered intravenously in 4 per cent. watery solution. Some preliminary experiments demonstrated the high toxicity of the drug for *T. brucei* both *in vitro* and *in vivo*; for example, intravenous injection of 70 c.c. of a 1 per cent solution into a mule whose blood was rich in *T. brucei* caused the disappearance of the parasites in the blood in half an hour.

Subcutaneous injections of the drug cause intense necrosis while intramuscular inoculation, in combination with substances such as olive oil and camphor to allay the irritation, did not appear to produce superior results to the intravenous mode of administration. It is admitted that it is not always easy to ensure that all the solution enters the vein in the case of restive cattle. On rare occasions the doses recommended above proved toxic and the susceptible animals in such cases were not necessarily small ones.

The toxic effect of antimony appears to be cumulative to that of arsenic and some deaths occurred in horses and mules that had been heavily dosed with white arsenic or given sodium arsenite intravenously prior to the emetic treatment. The cumulative toxic effect of the drug is generally revealed by different degrees of colic, varying from mere uneasiness to the severest manifestations of abdominal pain, accompanied by sweating, blowing, cyanosed mucous membranes, and rapid weak pulse; there may be salivation, purging, and rarely attempts at vomiting.

In August, 1913, 600 "grade" cattle en route to the South passed through a thick fly belt in Serenje, Northern Rhodesia. Out of the

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450 survivors examined three months later 50 had the appearance of fly-struck animals, and *T. congolense* was discoverable on blood examination. The affected animals were each given an intravenous injection of 1 gramme tartar emetic followed by a course of nine arsenious acid powders (three of 1 gramme, three of 1·5 gramme and then three of 2 grammes), the powders being administered on alternate days. As the result of this treatment more than 40 recovered so completely that six months later they crossed the Zambesi River as healthy cattle.

During 1914 several small lots, aggregating 100 head, of fly-struck cattle were treated in the vicinity of Fort Jameson, Northern Rhodesia; the results obtained were conflicting. On two farms lying 30 miles south-west of the township the author was able to cure 14 out of 24 affected oxen. On farms lying north of the township, however, where tabanids were numerous, treatment produced merely temporary improvement and cures were almost impossible to effect. Palliative treatment alone cannot be justified on farms inasmuch as there is a danger of keeping alive reservoirs to serve as foci for fresh outbreaks by adopting such a course. On transport routes, however, it is necessary, on the other hand, very often to prolong as much as possible an animal's working life.

Owing to the amount of labour required in administering the arsenic by the above method the author was led to enquire into the value of this part of the treatment. It was found that while heavy doses of white arsenic would clear the circulating blood temporarily it was almost impossible to effect a cure with white arsenic alone owing to its toxicity for the host's body. Three cattle treated with two or three injections of tartar emetic alone were, however, cured.

Early in 1915 the author treated a number of transport oxen that had to pass through about 100 miles of fly belt south of Kasama. While passing through the belt the oxen were given daily doses of about 10 grains of white arsenic. Not more than half the animals were showing pronounced symptoms when curative treatment was commenced consisting in the administration of 60 c.c. of 2 per cent. tartar emetic to each beast with in addition a course of arsenic powders in some cases. Every ox relapsed and although prior to the injection trypanosomes were only seen in the blood of a few animals yet after relapse *T. congolense* and *T. vivax* mixed were readily seen in almost every beast. The injections were repeated several times but no cures were obtained.

Towards the end of 1915 the author was in charge of transport oxen passing through the strip of Portuguese East Africa that lies west of Nyasaland. The oxen had to travel over 300 miles after passing through the first fly belt. Oxen showing fever or parasites (generally *T. congolense*, rarely *T. vivax*) were immediately injected, with the result that even next day they would show marked improvement. At the end of the journey 100 animals suspected of being fly-struck were injected and the dose repeated after a fortnight. Six months later 75 of these were able to undertake the return journey.

During 1916 the author successfully treated a number of *T. congolense* infected animals in North Nyasaland and near Fort Jameson with two injections of tartar emetic given at about 10-day intervals. At

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about the same time a single injection was given to a few cattle infected with *T. vivax*; sufficiently good results were obtained to confirm the opinion held in common with several other workers that this species is at least as susceptible to tartar emetic as is the smaller, commoner, *T. congolense.*

As compared with the results obtained in the treatment of bovine trypanosomiasis, the author's efforts to cure equine trypanosomiasis resulted in complete failure. During 1917 and 1918 more than 200 horses, mules and a few asses were treated. In 55 of these cases the blood was microscopically examined and *T. brucei* alone was identified in 42, *T. congolense* in 5, *T. vivax* in 1, mixed *T. brucei* and *T. congolense* in 6, and mixed *T. vivax* and *T. congolense* in 1. It was very probable that some of the cases classified as harbouring *T. brucei* also contained *T. vivax*, as it is impossible in the case of a mixed infection to distinguish between *T. vivax* and some of the long forms of *T. brucei.* Most of the animals were "struck" in the southern parts of what was German East Africa.

A number of prophylactic experiments were made in the treatment of equines that had to pass through fly country. One experiment described showed that "until some better method is made known it is worth while injecting mules every five days while they are in 'fly.' It will not prevent them contracting infection but it will check fever and conserve energy. It is, however, palliative, not prophylactic." Each dose was 25 c.c. of a 4 per cent. solution of tartar emetic.

The injection of trixidin (30 per cent. suspension of $Sb_2 0_3$ in olive oil), intramuscularly, into one horse caused such a severe local reaction that it could not proceed into the fly belt.

A donkey was given 50 c.c. of a 2 per cent. camphorated oily suspension of tartar emetic as recommended by VAN SACEGHEM and NICOLAS [see this *Bulletin*, 1917, Vol. 5, No. 1, p. 21] intramuscularly and a horse and a mule 70 c.c. each of the same suspension. Simultaneously they were inoculated subcutaneously with a drop of blood rich in *T. brucei* and *T. congolense.* In no case did *T. congolense* appear in the circulating blood but *T. brucei* were found later in all the animals, after 15 days in the donkey and after 13 days in the horse and mule. Another donkey received 50 c.c. of this suspension and a drop of blood rich in *T. brucei* only; trypanosomes appeared six days later. Three mules and 2 donkeys infected with both *T. congolense* and *T. vivax* or *T. congolense* alone suffered relapses after the administration of from one to three doses of tartar emetic alone, but two of these mules recovered by administering the tartar emetic alternately with sodium arsenite or sodium arsenite and atoxyl.

In an attempt to cure *T. brucei* infection in mules tartar emetic and sodium arsenite were administered intravenously alternately every three or four days over a period of 28 days. The dose of emetic was 60 c.c. of a 2 per cent. solution and of sodium arsenite 7 grammes in 70 c.c. Not a single cure resulted.

Forty cases of *T. brucei* infection received individual attention, involving variations in dosage, methods of administration, and combinations with other drugs. The results are summed up by stating that "alone or combined with other drugs there is no known method by which Tartar Emetic can be used to effect the cure of equines affected with *T. brucei.*" Formalin, ammonium bichromate, quinine,

optochinin, orpiment, trixidin, and tryparosan are stated to be among the drugs tried. Three mules only out of 140 infected did not suffer a relapse for more than two months after one month's treatment; they then only gave a temperature reaction but their blood was negative even when tested by inoculation of 50 c.c. into a susceptible animal. These animals were capable of doing work and apparently tolerant of trypanosomes. The author concludes as follows :—

"On account of its solubility, low toxicity and high trypanocidal action, Tartar Emetic is probably the most valuable drug available for use on a large scale in the treatment of domestic animals affected with trypanosomiasis. Its cheapness is also a point in its favour.

"It can be administered intramuscularly or intravenously, but the latter method is the better.

"One gramme every third day is the maximum that can be administered over a long period to even the largest domestic animals, but the same amount every fifth day is well tolerated by adult bovines and equines.

"Administered *secundum artem* it is capable of effecting cures in domestic animals infected with certain strains of *T. vivax* and *T. congolense*. On the other hand, one frequently encounters resistant strains of the same parasites.

"Nevertheless, were it possible to give the patient a course of injections extending over a long period, I believe that most cases of disease due to these two species of trypanosomes could be cured. Sometimes a single injection will bring about this result.

"Tartar Emetic shares with all other known drugs the property of being useless in the curative treatment of *T. brucei* infection of equines. Its sole value in connection with that form of trypanosomiasis is palliative, when given regularly to animals working in 'fly.'"

HORNBY (H. V.). **The Trypanosomes found in the Domestic Mammals in South-Central Africa.**—*Vet. Jl.* 1919. Apr. Vol. 75. No. 4. pp. 128–138.

The author contributes a very scholarly article reviewing the existing classifications of the African trypanosomes and detailing clearly his own observations and experiences during the course of the last five years. The author's own summary to the article, which should be consulted in the original by those interested, is as follows :—

"(1) The common trypanosomes found in Domestic Mammals in South Central Africa are three in number, viz. :—*T. brucei*, *T. congolense*, and *T. vivax*.

"(2) They are readily distinguishable by their morphological characters.

"(3) *T. brucei* is very fatal to equines, smaller ruminants, and dogs, but is almost non-pathogenic for cattle.

"(4) *T. congolense* is the commonest cause of trypanosomiasis of cattle, but it is also pathogenic for the other domestic mammals.

"(5) *T. vivax* resembles *T. congolense* in the forms of disease it causes in stock. Dogs are generally immune to its ill-effects.

"(6) The distribution of these parasites is coincident with that of tsetse-flies.

"(7) Different strains of the same species of trypanosome vary greatly in their range of virulence.

"(8) Individuals and races of the same species of domestic animal vary greatly in the resistance they offer to infection.

"(9) The presence in the blood of one species of parasite appears to inhibit the development of another.

"(10) A fourth species—*T. simiae*—causes disease in pigs. It is conceivable it may be only a variety of *T. congolense* modified by passage through the warthog."

CURASSON (G.). **Le galyl dans le traitement de la souma du cheval.** [Treatment of Equine *Souma* by means of Galyl.]—*Bull. Soc. Cent. Méd. Vét.* 1918. Dec. 5. *Rec. Méd. Vét.* 1918. Dec. 30. Vol. 94. No. 24. pp. 497–500.

The organic arsenical compound "galyl" appears to have been utilised hitherto in veterinary medicine only in connection with the treatment of epizootic lymphangitis [see this *Bulletin* (DOUVILLE), 1916, Vol. 4, No. 3, p. 111]. This author administered the drug in doses of 3 grammes intravenously, which were repeated if necessary. The product is dissolved in from about 100 to 150 times its volume of sterile water. After filtration it is injected immediately into the jugular vein. In the treatment of *souma* Curasson employed the following mixture, viz., galyl 1 gramme, sodium phosphate 0·37 gramme, caffeine 0·25 gramme, sodium benzoate 0·28 gramme. These quantities were placed in sealed ampoules and before use 5 c.c. of sterilised distilled water were added so as to fill the ampoule almost completely. The mixture becomes completely dissolved so as to form a clear liquid and filtration is not necessary. Moreover, the product becomes decomposed quickly on contact with the air. The contents of two such ampoules are injected slowly into the jugular vein. A week afterwards the operation is repeated using one ampoule only. If one takes into account the relatively small size of the native animals treated this dose of two grammes would correspond with the larger doses employed by DOUVILLE and by TRUCHE and GUIGNARD in the treatment of epizootic lymphangitis.

The intravenous injection of the above solution produced no ill-effects except in one case, in which the solution was injected rapidly; a somewhat marked respiratory distress was set up in this animal, probably due to the caffeine. Care should be taken to introduce the solution completely into the vein in order to avoid inflammation of the perivascular connective tissue.

The six animals treated were affected with the sub-acute or chronic forms of souma; blood examination was positive in every case showing trypanosomes of the *T. cazalboui* type. The author gives a detailed account of the progress of these cases. After the first injection the blood of four of the animals became sterile while that of the 5th still contained parasites, whose presence could be demonstrated by animal inoculation although they could not be recognised under the microscope. In the case of the 6th animal the parasites were still discoverable in blood smears. After the second injection no trypanosomes could be demonstrated in the blood of any of the animals. No relapses took place over a period of two months and the injection of 10 c.c. of blood from each animal into a sheep failed to set up infection. The animals rapidly regained condition and became capable of performing a normal amount of work.

SERGENT (Edm. & Et.) & LHÉRITIER (A.). **Dromadaires immunisés contre la Trypanosomiase "Debab."** [Dromedaries Immunised against the Trypanosomiasis known as *Debab.*]—*Bull. Soc. Path. Exot.* 1919. Feb. Vol. 12. No. 2. pp. 86–90. With 3 charts.

In this article the authors record two cases of immunity against *T. berberum* in dromedaries, viz., (1) a case of immunity acquired

as the result of artificial inoculation in the laboratory followed by attempts at curative treatment and re-inoculations performed with the object of maintaining and accentuating the immunity, and (2) a case of natural immunity. These two dromedaries showed so-called relative immunity inasmuch as they could be successfully infected artificially without showing any symptoms of disease. The immunity did not appear to be due to a feeble latent infection for the inoculation of large quantities of blood from the recovered dromedaries into susceptible animals failed to produce a reaction.

RODHAIN (J). **Sensibilité du Rongeur Africain,** *Tachyorectes annectens* **Th., au** *Trypanosoma Pecaudi.* [Susceptibility of the African Rodent, *T. a.*, towards *T. pecaudi.*]—*Bull. Soc. Path. Exot.* 1919. Feb. Vol. 12. No. 2. pp. 84–86.

In the beginning of 1916 severe losses occurred among pack animals comprising mules and asses belonging to Belgian troops stationed at Kibati towards the north of Lake Kivu. These animals were imported for the most part from the Egyptian Sudan and thus had to travel from Uganda. Blood examination showed that the deaths were due to an infection caused by a dimorphic trypanosome of the *pecaudi* type. This parasite was found to be very virulent towards the native grey rats, the dog, and the burrowing rodent indicated in the title, which was found in large numbers in the mountainous grass land bordering the Lake. Trypanosomes appeared in the blood in considerable numbers five days after inoculation and in enormous numbers in 14 days, at the time of death. No trypanosomes could be found in the blood of the normal uninoculated rodents. This little animal lives quite well in captivity on swedes and potatoes. It is much less active than the rat and has limited vision during the daytime. It burrows passages in the soil in much the same manner as moles.

The dimorphic trypanosome found at Kibati resembles the *pecaudi* more closely than the *brucei* species. Dimorphic trypanosomes of the *brucei* type found in the districts bordering on Uganda near the shores of Lake Victoria or nearer south always showed numerous short forms in which the nucleus was placed posteriorly. In the case of the Kibati parasite, on the other hand, forms with the nucleus placed slightly posteriorly were exceedingly rare.

BOUIN. **Guérison d'une chienne inoculée avec "Trypanosoma Marocanum."** [Recovery of a Bitch Inoculated with *T. marocanum.*]—*Bull. Soc. Cent. Méd. Vét.* 1919. Feb. 6. *Rec. Méd. Vét.* 1919. Feb. 20. Vol. 95. No. 4. pp. 96–100.

Dogs are extremely susceptible towards infections with pathogenic trypanosomes, and when inoculated with *T. marocanum* the ensuing infection generally terminates fatally. VELU in Casablanca observed no case of recovery even after treatment in 150 experimental dogs.

The author inoculated at Marrakech 12 dogs, out of which 11 died, the average duration of the disease in the course of the first passage being about 72 days. One bitch, however, inoculated with blood

from a naturally infected horse, survived the infection. In this animal trypanosomes appeared rapidly in the blood and were very numerous on the 3rd day after inoculation ; the temperature rose to 40·3° C. Thenceforward over a period of ten months the disease ran through alternating periods of exacerbation and improvement. The temperature was nearly always abnormally high but was highest during the periods of acute symptoms and during these periods also trypanosomes were most numerous in the blood. Ocular symptoms, which were the only external symptoms shown, became manifest on the 40th day after inoculation commencing with a slight keratitis but subsequently and especially between the febrile crises they became greatly intensified in character, involving complete blindness in the right and partial blindness in the left eye. Ten months after the inoculation, however, the animal showed complete recovery and inoculation of its blood into susceptible animals failed to reveal any trypanosomes. The blindness, however, remained. The animal is now being used for cross-immunity tests.

PONSELLE (A.). **Sur la culture des trypansomes.** [Cultivation of Trypanosomes.]—*C. R. Soc. Biol.* 1919. Feb. 22. Vol. 82. No. 4. pp. 163.

In a former note the author showed that the cultivation of the common frog trypanosome was determined by the degree of acidity of the culture media [see this *Bulletin*, 1918, Vol. 6, No. 2, p. 68]. Further researches have shown that the most favourable concentration in hydrogen ions required in the culture liquid mixed with the infected frog blood is 5·6 P_H^+ (Sörensen). At a temperature of 20° C. flagellated forms may be seen in about 18 hours in a mixture of 10 volumes of the solution to one of infected blood. After admixture of the blood the concentration is 6·2 P_H^+. This concentration in hydrogen ions brings about most rapidly the appearance of cultural forms but it may vary either towards neutrality or towards acidity within relatively wide limits without causing the growth of the organisms to cease. However, with such variations the appearance of the small flagellated forms becomes more or less delayed with the result that the trypanosomes preserve their original form as found in the blood when the solution tends to become neutral, or die without dividing when the acidity is much increased. The above requisite degree of acidity is by accident found in the ordinarily employed blood agar (NOVY-MACNEAL) medium by the gradual increase in acidity of the blood in the course of glycolysis *in vitro* ; this leads to the production of lactic acid, which is also found in MIYAJAMA'S blood broth medium owing to the acidity of the broth itself.

Although the degree of acidity is the determining factor in the cultural multiplication of the trypanosome there are other important accessory factors such as osmotic pressure (shown to be of prime importance in the case of *T. granulosum*) and the medium should, in order that cultivation may proceed, contain certain nutritive substances.

QUEVEDO (J. M.). **Experiments on the Treatment of "Tristeza" in the Argentine.**—*El Campo.* 1918. May. Vol. 2. No. 219. pp. 267–268. With 2 text-figs. [Extract in *Int. Rev. Sci. & Pract. Agric.* 1918. Oct. Vol. 9. No. 10. pp. 1207–8.]

"The author (Sub-Director of the Bacteriological Institute of the Ministry of Agriculture of the Argentine Republic) calls attention to the fact that 'tristeza' occurs in two forms—piroplasmosis or babeosis, caused by *Babesia bigemina*, and anaplasmosis, caused by *Anaplasma bovis* (*).

"Piroplasmosis.—Quinine compounds, and especially the bichlorhydrate, on account of its solubility, stimulate the secretions of the sick animal, which helps greatly towards recovery, but they neither decrease the numbers of the parasites nor cause any notable modification in their structure. For grave cases the author advises intravenous injections of 5 to 8 gm. of bichlorhydrate of quinine dissolved in 25 to 40 c.c. of water, or 10 to 20 gm. of quinine sulphate dissolved in ½ litre of water given by the mouth; the doses can be given after every 24 hours. Fractional doses, when given immediately when the first symptoms of the disease appear, may give good results with the slowly developing forms. Other febrifuges (e.g., antipyrine) did not give as good results as quinine.

"Amongst arsenical compounds, sodium cacodylate, arrhenal and atoxyl have been repeatedly tested by the author, who has found that though they act favourably they have no decisive influence on the course and issue of the disease.

"During the acute period, colloidal silver (ichtargan, collargol, protargol) reduce the temperature, but have no decisive influence on the course of the disease.

"Aniline dyes, and especially trypan blue, were found to be decidedly efficacious against the parasite. Trypan red has also given good results, while safranin and neutral red were less successful.

"Salts with a purgative action, such as magnesium sulphate are always useful in the treatment of bacteriosis. Stimulants (coffee etc.) are also useful.

"During the course of the disease, fresh forage, roots and decoctions should be given, while the grain and hay should be restricted.

"Anaplasmosis.—Trypan blue, trypan red and the other aniline compounds that are efficacious against piroplasmosis are inefficacious against anaplasmosis. Slightly better results have been obtained with a single dose of 3 to 4 gm. of atoxyl injected in the jugular. Very poor or worthless results were obtained with salvarsan (2 gm. injected in the jugular) and colloidal silver. Opening medicine and febrifuges are useful.

"In conclusion there are no therapeutic agents that suffice to combat anaplasmosis."

DOBELL (Clifford). **A Revision of the Coccidia Parasitic in Man.**—*Parasitology.* 1919. Feb. Vol. 11. No. 2. pp. 147–197. With 2 text figs. & 1 plate.

In this paper the author gives an exhaustive historical and analytical review of the hitherto recorded cases of coccidiosis in man together with a systematic and descriptive account of the various species into which the different coccidia described may be classified with a probable degree of certainty. His summary and general conclusions are as follows:

"From a study of the organisms themselves, so far as this has been possible, and from an analysis of all accessible records relating to them, I conclude that there are four distinct species of coccidia which may parasitize man.

* "According to other authors these are two phases of the same disease. See R., July 1918, No. 777.—ED."

These are: (1) *Isospora hominis* Rivolta, 1878 (emend.), discovered by Kjellberg in 1860, and recently investigated by Wenyon; (2) *Eimeria wenyoni* n. sp., a form discovered in 1915 by Wenyon; (3) *Eimeria oxyspora* n. sp., another new form, here described for the first time; (4) an undetermined species of *Eimeria* (?) which was discovered by Gubler in 1858. This last inhabits the human liver, whilst the others probably live in the small intestine. Probably some seventy cases of infection with the *Isospora* have now been seen, mostly in persons who have been in the Near East; but the other parasites appear to be extremely rare, and little is known concerning their probable geographical distribution.

"All these parasites are probably peculiar to man. There is no evidence that any of them is or can be parasitic in any other host. The prevailing belief that the coccidia of man are identical with those of rabbits, cats, or dogs, is therefore unfounded. Furthermore, there is as yet no good evidence to show that man may harbour any species of coccidia other than the four just enumerated. All these forms, however, require fuller investigation. They are here briefly and incompletely described from the data at present available.

"There is at present no proof that the coccidia of man—with the probable exception of the species occurring in the liver—can produce a clinically recognizable pathological condition of 'coccidiosis': and as yet no method of treatment which will eradicate an infection with any species has been discovered."

SCOTT (John W.). **Notes and Experiments on *Sarcocystis tenella* Railliet. II. Seasonal Infection.**—*Jl. Parasitology.* 1918. Dec. Vol. 5. No. 2. pp. 45–60.

In a former paper (1915) [see this *Bulletin*, 1916, Vol. 4, No. 1. p. 21] the author adduced evidence favouring DARLING'S suggestion that Sarcosporidia are merely aberrant varieties of the Neosporidia of certain invertebrates. Subsequent results have shown that the control lambs referred to in connection with these experiments were not entirely free from infection, and a report on the work is thus promised in a later paper.

Certain definite data, however, it is stated, were obtained with reference to the time of the year and other conditions under which infection occurs. By using more rigid methods of examination it was found that apparently 100 per cent. of adult sheep at pasture are infected with sarcocysts. The lambs examined for sarcocysts were raised under various conditions. Except in special cases the experimental lambs were kept in a dry lot from the time of birth, supplied with water from deep springs and fed with baled hay kept over from the previous season. Lambs over which there was no control are referred to as range sheep. It was noted that in all groups fed with grass 100 per cent. of the lambs became infected. However, seven out of nine of the control lambs, kept in the dry lot and given no green food, also became infected. Six out of eight lambs treated in the same way as these controls but fed twice weekly with a different kind of insect also became infected; however, two of these lambs had a very heavy infection.

Statistics obtained from the subsequent experiments performed are given (1) to show that the average size of the parasites increases with the age of the lamb, (2) to show that infection is discontinuous, (3) to determine the volumes of sarcocysts in old ewes and to show that infection extends through more than one season, and (4) to show the dimensions of some of the smallest sarcocysts measured.

The author finally discusses at some length McGowan's (1914) hypothesis with regard to the association of sarcosporidia with the sheep disease known as "scrapie." Part of this theory involved infection *in utero* and Scott claims to have presented evidence to show that this is certainly not the usual method of infection. The youngest age at which *S. tenella* has been found in lamb muscle is amply sufficient to account for infection after birth.

The chief points in the paper are thus summarised by the author :—

"(1) There is a well-defined seasonal infection of *Sarcocystis tenella* in the region of the Laramie Plains. It is not known whether this is true or not of other regions. Young stages of this parasite have been found in the muscles of both sheep and lambs throughout summer and early autumn, but not during the winter and spring.

"(2) Reinfection occurs in successive seasons, and old sheep are apparently as susceptible to infection as are young lambs. The theory of infection *in utero* is untenable. Seasonal, self-reinfection is improbable, though not entirely excluded, and the evidence indicates the origin *de novo* of successive infections.

"(3) If a second host is required, which seems probable, it is very likely that this host is an insect, and the definitive (sexual) stage of the parasite will be found here.

"(4) If a second host is not necessary, the sexual stage probably takes place in the intestine of the sheep, and in some unknown way the life-cycle falls under the influence of seasonal control.

"(5) In old ewes the larger sarcocysts are not nearly so abundant as the smaller ones. That some of the older sarcocysts do not grow to a large size is probably the most satisfactory explanation of this fact."

FROMME. **Können Hunde an Weilscher Krankheit erkranken.** [Are Dogs Susceptible to Weil's Disease ?]—*Berliner Tier. Woch.*, 1919. Jan. 23. Vol. 35. No. 4. p. 33 [extract].

In the course of their investigations into the nature of a human disease which has recently claimed considerable attention, especially as it occurred among soldiers in the course of the late War, and is known variously as infectious jaundice, WEIL'S disease, or rat-bite fever, two German workers, UHLENHUTH and Fromme, endeavoured to ascertain what role the dog played in the transmission of the disease. The causal organism of the disease, which was first isolated by Japanese workers, is known as *Spirochaeta ictero-haemorrhagiae.* This organism is isolated most readily from the blood of infected patients and inoculation of this blood intravenously into guinea-pigs produces characteristic symptoms after 5 to 6 days. The organism can also be demonstrated easily in the liver and transmitted to guinea-pigs by emulsions of liver substance. It can be readily cultivated in 3 per cent. serum water. Rats apparently play a considerable part in the transmission of the disease in natural conditions, and numerous observers have discovered these spirochaetes in the blood of wild rats.

Dogs appear to be generally immune against artificial infection with the virus as Fromme showed in 1916. A sporting dog inoculated intravenously with 2 c.c. of virulent blood and intraperitoneally with 10 c.c. of liver emulsion from a guinea-pig that had succumbed to the disease subsequently showed no symptoms of jaundice although keratitis and conjunctivitis appeared three days after the inoculation. In further inoculation and feeding experiments with dogs no symptoms of disease could be set up.

In natural circumstances symptoms of jaundice are not rarely seen in dogs and in most cases these symptoms appear as complications of duodenal catarrh. The authors made a careful study of a case in which a dog had succumbed after showing symptoms of very marked jaundice. The first symptoms shown were deep yellow discolouration of the sclerotic, general depression, and loss of appetite. It died four days afterwards. On post-mortem examination generalised icterus, emaciation, and enlargement of the spleen were observed. The small intestine contained very dark clotted blood. There was no catarrhal inflammation of the intestinal mucous membrane, the gall bladder was normal, the lung contained numerous petechiae similar to those found in a guinea-pig that has succumbed to WEIL's disease.

In the liver were found isolated spirochaetes similar in form to *Sp. ictero-haemorrhagiae.* A guinea-pig injected with material from the liver and killed seven and a half weeks afterwards was found to contain on microscopic examination spirochaetes in the kidneys and liver similar to those found in WEIL's disease. The serum of the dog was found to have a considerable protective action against the virus of WEIL's disease although it was not sufficiently strong to inhibit death taking place in experimental animals.

The above result acquires some importance inasmuch as the affected dog came from a locality in which the disease affected human beings and apparently also wild rats. The author refers to an observation made by KRUMBEIM and FRIELING, 1916, regarding two cases of the disease in human beings which seem to be connected with the death of a dog from jaundice. It thus appears highly probable that dogs may become affected with WEIL's disease under natural conditions and owing to the ratting propensities of the canine species the chances for acquiring the disease from rats either per os, through the conjunctival mucous membrane, or by means of insects are considerable. The possibilities for subsequent transmission from dog to man are, of course, very considerable.

DISEASES DUE TO METAZOAN PARASITES.

SERGENT (Edm.) & LHÉRITIER (A.). **Gale du dromadaire (Première note).** [Mange in the Dromedary (Preliminary Note).]—*Bull. Soc. Path. Exot.*, 1919. Feb. Vol. 12. No. 2. pp. 94–99. With 5 text figs.

Mange, or *djrab* in Arabic, is the second most important disease of dromedaries in Northern Africa, the first in order of importance being the trypanosomiasis transmitted by tabanids and known as *debab.*

No study of the morphological characters of the dromedary sarcopt appears to have been made hitherto. Briefly the characters of *Sarcoptes scabeii* var. *cameli* are as follows:—The dorsal scales of ovigerous female are numerous, conical, short and rigid, and uniform in length. There is no anterior furrow. The posterior furrow extends to about one fifth the width of the body. There are three spicules on the notothorax which are short and thick. The notogastric spicules number six on each side of the body and are rigid-looking, long, and have truncated or slightly bifurcated ends. A seventh small spicule

is situated near the extremity of the body close to the origin of two fine hair-like filaments. The chitinous thickenings in the male supporting the genital shield and the posterior pairs of legs are not united. The following were the average dimensions—eggs 191 by 102μ, larva 176 by 124μ, nymph 224 by 154μ, pubescent female 349 by 257μ, ovigerous female 447 by 321μ, male 250 by 186μ.

In one outbreak studied by the authors involving a herd of 15 dromedaries the mange remained more or less localised for several weeks and then suddenly spread over the whole of the bodies of these animals. The spread of the infection brought about the death of the animals in from two to three months. The local lesions were—absence of furrows, scaly crusts, loss of hair; the skin became wrinkled, thickened and brittle. The parts affected with thin skin were mostly attacked such as the lips, elbows and groins. The croup was the least affected. The general symptoms were pruritis, large sores being set up owing to violent rubbing, loss of condition leading to extreme emaciation although the appetite remained normal for a long time, and finally oedematous swelling of the limbs. The disease is thus of a serious character and in untreated cases proves fatal.

The various methods of treatment employed in the case of equine mange and such as could be carried out in the field were undertaken. Vigorous application of a weak solution of cresyl in soapy water led to the death of all the animals thus treated. The dromedary appears to be an animal extremely sensitive to moisture, its temperature is lowered immediately its coat becomes wet. The best treatment so far appears to consist in the application of a tarry product made by the natives from *Guniperus phoenicea* and *Thuya articulata*. This gives good results when applied thoroughly at the commencement of the disease and repeated.

The authors next give an account of the lesions and general symptoms produced in human beings through contact with affected dromedaries. These may be of a very serious nature and require energetic treatment.

[This account of the transmission of mange from the dromedary to man is not new. Neveu-Lemaire (*Parasitologie des Animaux Domestiques*, 1912), states that "it has been shown that mange affecting the dromedary and the camel is transmissible to man, and in Egypt, according to Piot, nearly all the camel men are contaminated by their animals."—Ed.]

Velu (H.). **Existence au Maroc d'une nouvelle espèce d'*Ornithodorus*.** [A New Species of Ornithodorus in Morocco.]—*Bull. Soc. Path. Exot.* 1919. Feb. Vol. 12. No. 2. pp. 99–104. With 9 text figs.

The author was called upon to investigate the cause of an extensive erythema produced in pigs bitten by a nocturnal insect. In the interstices of the walls of a very ancient Moroccan habitation a very large number of Ornithodorus was found presenting special characters. A detailed description of this tick is given. It is said to resemble rather closely *O. turicata* A. Dugès, 1876, from which it can be immediately distinguished by the appearance of the tarsae and by the complete absence of smooth zones. It is thus placed in a new species, *O. marocanus*, having the following characters:—body covered with

granules, rounded posteriorly, terminating anteriorly in a blunted point, no visible discs, no eyes. The first segment of the tarsae decrease successively in size from the first to the last pair of legs. The tarsae are very slightly bosselated.

This tick attacks both man and the pig. Its bite is painful and sets up in a few hours a livid petechial haemorrhage from 1 to 2 cm. in diameter. The centre of this reddened patch is often indurated. The condition lasts four or five days. The colour becomes intensified from the 12th to the 36th hour after the bite and assumes a deep violet tint. In some cases the bites may set up a transitory febrile reaction.

HADWEN (S.). **Parasitic Diseases.**—*Jl. Amer. Vet. Med. Assoc.* 1919. Feb. Vol. 54. (New Series. Vol. 7.) No. 6. pp. 639–642. With 3 text figs.

In this paper Hadwen discusses some of the injuries caused in animals by ticks. He refers to a number of infections set up by organisms such as the Preisz-Nocard bacillus, *Cryptococcus farciminosus*, the necrosis bacillus, and staphylococci by the agency of amblyommid ticks, such affections as they occur in East Africa and Rhodesia having been grouped together recently by JARVIS (E. M.) under the name "Exotic lymphangitis" [see this *Bulletin*, 1918, Vol. 6, No. 2, p. 95]. On the western slopes of the Rocky Mountains in Canada outbreaks of fistulous withers and poll evil have occurred among unbroken "range" horses. These outbreaks appear early in the season and although their origin has hitherto not been discovered the author has now become convinced that ticks play an important role. *Dermacentor albipictus* would appear to be the worst offender, and possibly also *D. venustus*. The former is commonly called the "winter" tick and in some regions of British Columbia, especially where poll evil and fistulous withers are common, horses are heavily infested with these ticks. The favourite seat for attachment is along the whole length of the mane from the poll to the withers; when a heavily infested animal is examined a necrotic spot will be noted at each point of attachment if the tick has been attached for a few days. The necrosing action following upon the bites of *D. albipictus* on horses may be as great as the after effects of the bites of *D. venustus*, which have been well studied in other animals. The necrotic spots may easily be a favourable entrance point for bacteria. A considerable amount of pruritus is well known to persist for very long periods after the bites of *D. venustus*. The following dressings are recommended for rubbing into the manes of affected animals: (1) butter and lard each 18 lbs., resin 12 lbs., Gallipoli oil 1 gallon; (2) train or seal oil 4 gallons, tar ½ gallon, oil of turpentine 1 lb.; mix and rub in well after shearing.

DORSET (M.), MCBRYDE (C. N.), NILE (W. B.) & RIETZ (I. H.). **Observations Concerning the Dissemination of Hog Cholera by Insects.**—*American Jl. Vet. Med.* 1919. Feb. Vol. 14. No. 2. pp. 55–60.

In this paper Dorset gives a brief summary of an extensive series of experiments carried out by himself and the other workers mentioned above of the United States Bureau of Animal Industry.

Their attentions were confined to two species of insect, viz., the common house fly, *Musca domestica*, and the closely related lesser house fly, as the representatives of non-blood sucking flies, and the stable fly, *Stomoxys calcitrans*, as the representative of the class of biting flies.

Experiments with house flies.—These flies are often seen in great numbers feeding on the conjunctival secretions of pigs affected with swine fever. The first experiment was directed towards obtaining information as to whether they are capable of becoming carriers of infection after having been in contact with these secretions. The flies were exposed to infection by crawling over the eyes of sick pigs or over the eye secretions on swabs and then they were ground up in sterile salt solution and injected after varying intervals of time ($\frac{1}{2}$, 1, $1\frac{1}{4}$, 4, 24, and 48 hours) into susceptible pigs. Out of five pigs each injected with one house fly that had been kept for 24 hours after having been in contact with infective secretions four died of swine fever and one remained well. It would thus appear that house flies that had come in contact with the lachrymal secretions harbour the virus for at least 24 hours.

Next, tests were made to ascertain the infectivity of house flies that had been allowed to feed on the blood of sick pigs. Three flies were allowed to feed singly in tubes on the blood of sick pigs; one pig was injected with a fly 40 minutes, a second with a fly 24 hours, and a third with a fly 48 hours after feeding on the blood; as a result all of the pigs died of swine fever. Six flies were then allowed to feed on infective blood. Beginning two days after this feeding one susceptible pig was injected each day with one of these flies ground up in salt solution; all these pigs rapidly contracted swine fever and died.

Having thus ascertained that the house fly may, for some days, harbour the swine fever virus derived from the lachrymal secretions or the blood of infected pigs it became necessary to determine whether the flies could transmit the disease under natural circumstances. Owing to the difficulty experienced in inducing the flies to feed when desired it was found necessary to have recourse to the following procedure. The flies were grasped by the wings with a pair of forceps and were held so that their legs and mouth parts came in contact with the eye secretion of a sick pig; they were then made to come into contact with the eye of a healthy pig in exactly the same way, in order to imitate as far as possible what might take place in nature. Eight groups of four pigs each were thus exposed to eight infected flies (one fly per group of four pigs). Twenty four of these pigs rapidly succumbed to swine fever, four took the disease in a somewhat sub-acute form, and four remained well; an interval of five minutes only elapsed between the time when the flies were placed in contact with the diseased secretions and then placed on the susceptible pigs.

In a second test four pigs were each exposed to a different infected fly four hours after the fly had been infected; three of these pigs contracted swine fever and died, the fourth remained well and later proved susceptible. In another test one pig was exposed to an infected fly 24 hours after the fly had been infected; this pig also contracted swine fever and died. These experiments show that the disease is very easily transmitted by transferring the lachrymal secretions of sick pigs on to the eyes of healthy pigs.

A few experiments were made with nasal secretions and on the whole the results were similar to those obtained with the eye secretions.

House-flies and so-called lesser house flies were then allowed to walk on or about the eyes of sick pigs in a natural manner. They were imprisoned first in a tube and then allowed to walk around the eye of an infected pig. The flies were transferred to clean tubes prior to being applied to the eyes of healthy pigs. Thirteen susceptible pigs were exposed in this manner to infection, most of the exposures being made within 30 minutes after the fly had been infected with the secretions although two were made after an interval of 24 hours. Five of these pigs contracted swine fever and died. The remaining pigs remained healthy and were later found to be susceptible. A further series of tests were made with house flies that were first allowed to feed on the eye secretions of sick pigs and then permitted to feed on small artificial abrasions or scratches on the ears of healthy pigs. Out of three pigs thus exposed to infection 30 minutes after the fly had fed on the secretions one contracted swine fever and died with typical lesions; both of two pigs exposed after four hours rapidly sickened and died.

Four pigs were exposed by allowing infected flies to feed on small artificial wounds as described above but in this case the flies were first infected by feeding on the blood of a sick pig; two of these pigs contracted acute swine fever and died with typical lesions. The above experiments would seem to show that house flies are capable of taking up and harbouring the virus of swine fever and under experimental conditions they transmitted the disease in a certain number of cases to healthy pigs. The question still arises, however, as to whether these flies actually tend, in nature, to spread swine fever. To obtain some light on this problem a number of fly-proof screened pens were built and in each of these were placed one or two susceptible pigs. Four separate experiments were carried out. Flies were caught daily in the "virus" barn with traps and nets and immediately after capture they were introduced through a special opening into the screened pens in which the healthy pigs were kept. A number of flies, amounting to several thousand, was thus introduced daily, for 24 days in two cases, and for 21 days in another. All these pigs remained perfectly well and were later proved to be susceptible. In two other experiments there was introduced into the pens a smaller number of flies consisting for the most part of flies caught when actually feeding on the eye secretions of sick pigs. In one of these tests the result was entirely negative and in the other the pig developed swine fever 25 days after the first exposure to the flies, and six days after the last exposure. No great stress is laid upon this one positive result.

Experiments with the blood-sucking stable fly. This fly was selected inasmuch as it is found everywhere, is a voracious feeder on animals, and is prevalent at a time corresponding very closely with the seasonal incidence of swine fever. The results obtained with this fly, however, it is stated, did not necessarily indicate what would happen with other blood-sucking flies.

Stable flies were caught and allowed to feed on sick pigs in various stages of the disease, then, after having been kept for varying lengths of time, they were ground up in salt solution and injected into

healthy pigs. All pigs injected in this way rapidly succumbed to swine fever. In two such tests the flies were captured when biting sick pigs on two farms where the disease had broken out; the flies after having been held for 24 hours were injected into healthy pigs and produced swine fever in all cases.

In the next series of tests efforts were made to produce the disease by the direct bite of stable flies that had previously bitten infected pigs. Considerable difficulty and uncertainty surrounds these tests. It was found difficult to induce the flies to bite when it was desired and the results of the bites varied; in some cases when the flies bit a pig they would draw blood and in other cases they drew no blood. It was thought that the amount of infection a fly carried away mechanically on its proboscis might depend a good deal on how it happened to bite, that is, on whether it drew blood and thus transported a considerable amount of virus. Sixteen different pigs were exposed to the bites of as many different lots of stable flies at intervals varying from five minutes to 48 hours after feeding on six pigs in varying stages of the disease, some being on farms where a natural outbreak of the disease existed. The number of infected stable flies that bit each pig was in most cases but one or two; three of the pigs, however, were bitten by six, seven, and eight flies respectively. The results of this test were that 11 of the pigs remained perfectly well and were later proved to be susceptible, four died showing typical lesions post-mortem, and one became sick but recovered and was later proved to be immune. Of the pigs that developed swine fever two were bitten by one fly one hour after feeding on a sick pig, one was bitten by one fly 18 hours after feeding, one by two flies 18 hours after feeding, and the last pig was bitten by three flies 24 hours after feeding on sick pigs. Special attention is drawn to these results inasmuch as here apparently five of the 16 pigs apparently became infected by the bites of stable flies but, however, the period of incubation was considerably longer than is usually seen in swine fever; the pigs that died showed the first symptoms on the 12th, 15th, 17th, and 20th days respectively. Considering the length of this period in these cases it is felt that the possibility of accidental infection could not be absolutely excluded. It might be, however, that the period of incubation was lengthened because the quantity of virus introduced was almost infinitesimal.

The next set of experiments with stable flies, infected by biting sick pigs, was carried out by throwing dead infected flies into pens containing healthy pigs, and by putting such flies into the feeding troughs. In the first experiment 146 dead flies were thrown into a pen with two pigs, 50 one day, 50 another, and 46 on another; of these flies 12 were dropped into the feeding trough. One of the pigs sickened ten days after the first lot of flies was introduced into the pen and the other, six days later, having perhaps contracted the disease from the first pig; one died, the other became a chronic case.

The second experiment was similar to the preceding except that only 100 flies were thrown into the pen. Both the pigs involved sickened, on the 7th and 8th days, respectively. In a third test four pigs were each fed with one infected stable fly mashed up in their feed, and they all remained well. In a fourth test five pigs were each fed with six stable flies that had recently bitten six sick pigs;

three sickened after eating the flies, while the other two remained well.

A series of screened pen experiments with stable flies, similar to those carried out with the house flies, was then performed. The stable fly does not bite well in closed pens or in shaded places, it bites best outside in the warmth and light and retires to the shade for rest. Special pens were thus constructed, about 6 feet square, boarded for about 3 feet from the floor, enclosed with wire gauze 3 feet above the boards, and with a tight roof; special arrangements for feeding shoots were made on the sides. In one pen such as this sick pigs were kept and stable flies were caught and put with them daily, and they were seen to feed on the pigs. Each day a number of flies was caught alive in this pen and introduced into similar pens with healthy pigs. Seven such experiments were made. On an average about 50 flies were introduced for from seven to nine days into each of the seven pens containing healthy pigs. The results of these tests were very different from those with the house fly; in five of the seven pens pigs became rapidly infected with swine fever while in the remaining two pens the pigs remained apparently healthy, but when tested later they seemed more resistant than normal pigs to the disease.

The authors record that during the autumn of 1918 stable flies were observed biting the ears of sick pigs viciously on farms where outbreaks of swine fever were being investigated. Blood was seen dropping from the tips of their ears as the result of these bites; in one case there were so many of these flies biting a sick pig that one application of a small tube only $1\frac{1}{8}$ inch in diameter to the ear of a sick pig resulted in the capture of 25 flies. These flies were also observed in considerable numbers biting pigs on farms in Iowa. There is just a possibility that the virus undergoes a cycle of development in the stable fly or some other fly and experiments are being carried out in this connection.

[A rather full extract is given above of this important work inasmuch as it might throw some light on the transmission of some tropical diseases of animals similar in nature to swine fever, and more especially rinderpest.—Ed.]

Hall (Maurice C.). **Practical Methods of Treatment for Worm Infestation.**—*Jl. American Vet. Med. Assoc.* 1919. Apr. Vol. 55. (New Series. Vol. 8.) No. 1. pp. 24–45. With 1 text fig.

In this paper the author gives a summary description and a discussion of the numerous experiments previously undertaken by him in order to estimate the efficacy of various anthelmintics for the treatment of worm infestations in the domesticated animals. Reference has already been made to a number of these in this *Bulletin*.

Horses.—(1) Strongyles (Strongylus, or Sclerostomum, and Cylicostomum). It is concluded that in amounts of 16 to 18 mils (c.c.) oil of chenopodium in one to three days followed immediately or at an interval with linseed oil may be expected to remove all strongyles from the caecum and colon from the horse in many cases, provided the animal is fasted 36 hours previous to treatment.

(2) *Oxyuris equi.* The author's experiments confirm the idea expressed by Railliet as to the readiness with which pin worms may

be removed. They may be cleaned out by oil of chenopodium in 16 mil doses, followed immediately by a quart of linseed oil in horses that have fasted not less than 24 hours, or by 2 drachm doses of tartar emetic in the feed daily for five days. Fasting for less than 24 hours interferes with the efficacy of oil of chenopodium against these worms and iron sulphate in 2 drachm doses daily for seven days is unsatisfactory.

(3) Ascarids. The removal of these worms from the horse would appear to have presented no special difficulties, for in man, dogs and swine, they yield very readily to treatment. However, the author's experiments proved that NEVEU-LEMAIRE (1912) was quite right in stating that none of the numerous treatments commonly employed, such as tartar emetic, turpentine, santonin, empyreumatic oil and benzine, give satisfactory results, and in view of this the writer is unable to make recommendations in regard to treatment for ascarids in the horse. Chenopodium is specifically ascaricidal in man, dogs, and swine, and has a very high anthelmintic value. Its low efficacy against ascarids in the horse in the doses used and in the way in which it was given in the course of experiments, was a surprise. Perhaps a satisfactory chenopodium treatment may be obtained by giving a larger number of fractional doses over a longer period, as in the treatment of hook-worm infestations in the dog. RAILLIET (1915) says the preference among practitioners is for tartar emetic or arsenic to remove ascarids from the horse. Tartar emetic has the disadvantage of being a severe gastro-intestinal irritant and dangerous. Experimental treatment with repeated doses of arsenic was found to be a slow and not very certain procedure.

Cattle.—Stomach worm (*Haemonchus contortus*). No experimental tests upon this worm in cattle have yet been carried out but inasmuch as the parasite is identical with that ordinarily causing parasitic gastritis in sheep a treatment analogous to that advised for sheep may be adopted. Safe and conservative doses of copper sulphate are preferred repeated at long enough intervals to permit the subsistence of inflammation and to avoid cumulative effects. The dose for calves would be about 1,000 mils of 1 per cent. solution in water for animals two to three months old, grading the dose up conservatively from this point and repeating treatment at intervals of a month or six weeks from spring until after frost.

Sheep.—(1) Stomach worm (*Haemonchus contortus*). In the course of the author's experiments a number of treatments were tested including the gasoline treatment, the creosote treatment, and the copper sulphate treatment. In these experiments it was found that the use of gasoline and creosote had many disadvantages [see this *Bulletin*, 1918, Vol. 6, No. 2, p. 106]. The copper sulphate treatment was devised by HUTCHEON in South Africa and was very thoroughly tested. As the result of experiments and on some additional evidence obtained in Virginia and Michigan in the control of stomach worms in sheep and goats, Hall is under the impression that these worms can readily be kept under control at a point where they will have no discernible effect on the health of the sheep, and perhaps even be eradicated from the range involved, by the administration of 50 mils of 1 per cent. solution of copper sulphate every month or so except during the winter in localities where the winter means freezing weather. A special

improved apparatus for drenching sheep in large numbers is depicted in this paper.

(2) Nodular worm infestation. This appears to be a serious disease in the United States of America. In their experiments in the Bureau of Animal Industry, Hall and FOSTER, found an efficacy of 17 per cent. for chloroform and castor oil, 16 per cent. for gasoline in milk, 9 per cent. for chenopodium, 0·6 per cent. for copper sulphate solution, and 0 per cent. for powdered copper sulphate in capsule and petroleum benzine in milk. The complexity of the ruminant stomach and the fact that the adult nodular worm is in the caecum and more or less remote from the mouth are facts which make oral medication for the nodular worm a difficult matter. The bulk of the injury to the worm is done in the larval stage when the removal of the adult worm, if accomplished, probably does little for the sheep unless the anthelmintic treatment is part of an eradication programme contemplating adequate prophylaxis as well. BRUMPT has devised a method consisting in the administration of a preliminary dose of 25 to 30 grammes of sulphate of soda to render the faeces fluid followed by a rectal injection of 1 to 1½ litres of water containing thymol in emulsion, the thymol being at the rate of 1 gramme per three to five kilos weight of sheep. The sheep is suspended by its hind legs during the operation and the abdomen then manipulated so that the liquid injected penetrates the intestines.

Pigs.—Ascarids. The author's experimental work showed that chenopodium was superior to any other drug for the removal of these worms. The dose is 1 mil of the oil for every 25 lbs. body weight up to 8 mils, following the dose immediately by a purgative such as 1 oz. castor oil for animals weighing up to 100 lbs. and double this amount for those weighing over 100 lbs. The animal should be fasted for at least 24 hours before treatment and not fed for two or three hours after treatment. FOSTER and the author showed that mineral mixtures and the so-called tonics were inadequate and unsatisfactory substitutes for anthelmintic treatment.

Dogs.—(1) Ascarids may be safely eliminated by the use of oil of chenopodium administered in a single dose of 0·1 mil per kilo body weight. The medicament is best given in capsules, soft capsules being found to be entirely satisfactory. A dose of castor oil is administered immediately after the chenopodium inasmuch as this drug is toxic, constipating, and a gastro-intestinal irritant. The castor oil also retards absorption and distributes the drug over a larger surface of the gastro-intestinal mucous membrane. Dogs can be given double the minimum lethal dose of oil of chenopodium with castor oil and will survive. The administration of this anthelmintic is contra-indicated in cases of severe or chronic enteritis, organic heart trouble of certain types, mild cachexia, severe gastro-enteritis, and severe infectious diseases, especially distemper. Cachectic dogs may be put on a nourishing diet before treatment or santonin may be administered instead. This drug is given in small doses daily for a number of days. The treatment is then suspended for a few days and repeated if necessary.

(2) For the removal of whip worms from the dog santonin is the best drug known to the author. As the result of his experiments he recommends its administration in doses of a grain a day with an equal amount of calomel. This is given for a week and then suspended for a week and afterwards repeated as often as necessary.

(3) The most serious of the intestinal parasites of dogs is the hook-worm. The treatment of such infestations calls for considerable judgment. The animals already have an irritated intestine due to hook-worm petechiae, and, if they are clinical cases of uncinariasis or kennel anaemia, they are weak, emaciated, and anaemic and it is easy to kill such dogs by anthelmintic treatment. The worms are difficult to remove and call for larger doses of drugs than do ascarids. They will not respond to such drugs as santonin, which are non-irritant, and they require the use of such drugs as chenopodium, chloroform or thymol, all of which act more or less as gastro-intestinal irritants. Under these conditions it may often be advisable to combine nursing treatment with repeated treatments by small doses of anthelmintic at intervals of two weeks or so, until the removal of the worms and the nursing improve the condition of the animal so that it can endure the relatively drastic treatment necessary to clean out the infestation.

Cats.—Ascarids. A treatment found successful was to give the cat ½ oz. of castor oil, puncture a 5 minim soluble elastic capsule of oil of chenopodium with a pin, and squirt from 2 to 4 minims of the oil against the roof of the mouth or against the tongue. Cats are twice as susceptible as dogs to chenopodium poisoning.

Poultry.—Heterakids, including the large Ascaridia of the small intestine and the small Heterakis of the caecum. Hall and Foster (1918) found an efficacy against Ascaridia of 76 per cent. for turpentine in 2 mil doses mixed with an equal amount of olive oil and followed immediately by 8 mils of castor oil, and an efficacy of 69 per cent. for oil of chenopodium in a dose of 0·02 mil mixed with 2 mils of castor oil and preceded by 2 mils of castor oil, and an efficacy against Heterakis of 19 per cent. for chopped tobacco stems soaked in water.

"A consideration of the foregoing shows that in the present state of our knowledge our best anthelmintics for certain purposes are oil of chenopodium, which is perhaps the most valuable anthelmintic known, santonin, valuable where repeated doses are desired and gastro-intestinal irritation must be avoided, turpentine, which acts in some respects like a weaker oil of chenopodium, copper sulphate, valuable in the ruminants, where its emetic action is not manifested, and tobacco, which seems to be adapted to the peculiar task of removing heterakids from the ceca of poultry."

Ransom (B H.). **Practical Methods of Prophylaxis against Worm Infestations.**—*Jl. American Vet. Med. Assoc.* 1919. Apr. Vol. 55. (New Series. Vol. 8.) No. 1. pp. 46–56.

In this paper Ransom discusses the control of a few of the forms of worm infestations, which he has had under investigation at various times, by preventive measures.

(1) "*Summer sores*" *of equines.* The work of Descazeaux in South America, Railliet in Europe, Van Saceghem in Africa, and Bull in Australia has shown that the worms capable of setting up certain granulomatous growths and "summer sores" on the skin of horses are the larvae of one or more species of *Habronema.*

Extracts of the works referred to may be found in previous numbers of this *Bulletin.* Two species of Habronema are found which live as

adults in the stomach of the horse. Prior to the work of these investigators the author proved in the case of one of these species (*Habronema muscae*) that the common house-fly acts as the intermediate host. With the knowledge that these worms are responsible for "summer sores" and are transmitted to horses by flies which in turn acquire the parasites as a result of breeding in manure from horses harbouring the adult worms in their stomachs, it is quite possible that at least one solution of the summer sore problem may be reached by the solution of the problem of eradicating the flies that breed in horse manure.

(2) *Muscle cysticerci in sheep.* A very large number of sheep carcases had been condemned every year in the United States of America as the result of this infestation. Investigation has conclusively demonstrated that instead of being the larvae of a rather dangerous tapeworm of man (*Taenia solium*), as formerly supposed, they were not forms transmissible to human beings but belong to a previously unrecognised species of tapeworm of the dog (*Taenia ovis*). A much less severe rule of meat inspection thus becomes applicable. Prophylactic measures consist in destroying unnecessary dogs, burning or burying the carcases of sheep or otherwise disposing of them so that they cannot be eaten by dogs, feeding no uncooked mutton to dogs, and further ensuring the freedom of dogs from tapeworms by periodical anthelmintic treatment.

(3) Ascaris suum *or* Ascaris lumbricoides *of pigs.* Recently STEWART of the Indian Medical Service [see this *Bulletin*, 1918, Vol. 6, No. 2, p. 97] made the remarkable discovery that if the eggs of Ascaris are fed to rats and mice they hatch out in the intestine and the embryos migrate to the liver and other organs, including the lungs, meanwhile undergoing considerable growth and development. From the lungs the larvae migrate up the trachea and may be recovered from the saliva. They then pass down the oesophagus, through the stomach and into the intestine. They remain for a time in the caecum but finally leave the body in the faeces. About two weeks are required for these migrations. STEWART failed to infect pigs by feeding them on Ascaris eggs, and was led to conclude that rats or mice act as intermediate hosts. According to his view the transfer of the larvae to pigs or human beings is brought about through the contamination of food or water by the saliva or faeces of infested rats or mice during the time the parasites are present in the mouth or intestine of these animals. Ransom and FOSTER repeated STEWART'S experiments with results very similar to his but determined some additional facts and demonstrated that the parasite has a direct life history. They claim to have proved conclusively that pigs become infected with Ascaris as a result of swallowing the eggs of the parasite, the larvae undergoing the same migrations as they do in rats and mice with the difference that when they reach the pig's intestine after passing through the lungs they settle down and slowly develop into adult worms. In rabbits and guinea-pigs, on the other hand, they found that the larvae as in rats and mice were unable to continue their development in the intestine. The cycle in these small rodents would thus represent a transient existence in strange hosts and it affords no evidence that these animals act under any circumstances as intermediate hosts. As was shown in STEWART'S experiments with the rodents a fatal

pneumonia may be set up in pigs by the passage of migrating Ascaris larvae through the lungs.

Ascaris is harboured by a high percentage of pigs in all parts of the world. Though it appears to be most common in pigs less than a year old it is of rather frequent occurrence in older animals. The soil of places occupied by infested animals may become heavily laden with eggs passed in the faeces. Ascaris eggs are endowed with a remarkable vitality and have been kept alive for as long as five years. They can survive for some time in a dry condition and are not affected by ordinary disinfectants. Formaldehyde solution, for example, makes an excellent medium in which to incubate the eggs to study the embryonic development of the parasite. The problem of preventing Ascaris infection thus becomes difficult.

Evidence is available which indicates that as pigs grow older they are not only less liable to injury by Ascaris but are less susceptible to infection. The protection of very young pigs is therefore of particular importance. A fertile source of infection in the case of the sucking pig would be the teats of the sow, soiled with the dirt of the pigsty. This dirt may contain many Ascaris eggs, which would be swallowed by the young pig in sucking. Special care should thus be taken of the sow just before and during the suckling period with respect to cleanliness of the animal itself and of the place in which it is kept.

(4) Haemonchus contortus *of sheep and other ruminants.* Investigations made a number of years ago by the author proved that this parasite has a direct life history, no intermediate host being necessary. [The life-cycle of this worm substantially as described by Ransom may be referred to in an extract of the work of another author (VEGLIA), in this *Bulletin*, 1917, Vol. 5, No. 1, p. 30.—ED.] From the knowledge so far obtained it appears safe to assume that practically all infection in a pasture will die out within a year after the removal of sheep and other ruminants. Apparently also there is little residual infection in fields that have been ploughed up and replanted. The length of time the adult parasites may live in an infested animal is uncertain, but they appear to be rather short-lived inasmuch as the number rapidly diminishes in animals that are removed from pasture and placed in stables or dry yards. In such cases the chances of re-infection are comparatively slight. Sheep, however, that were kept on frequently cleaned board floors still showed a few stomach worms at the end of about eighteen months, but it is believed that these resulted from re-infection rather than that they had survived in sheep after their removal from pasture. After considerable experiment, it is stated, the conclusion has been reached that the only way of preventing infection among lambs is to take them away from the ewes at birth, feed them artificially on sterile milk, and keep them in clean pens and pastures, using scrupulous precautions to avoid the introduction of infection with contaminated feed or water, or dirt carried on the feet of attendants. Such a rigorous method could not be applied in practice. In view of the fact that it is impossible in practice to get rid of stomach worms from sheep or to raise lambs quite free from them, one has to proceed on the assumption that sheep are invariably, although perhaps only very slightly, infected with the worms, and the important economic problem to be solved thus is to keep the number of worms down to such a small limit that they are incapable of doing any appreciable damage.

Successful results are being obtained by CURTICE (Cooper), who is in charge of the work undertaken in this connection by the Bureau of Animal Industry, in the following manner.

"During the autumn and winter the breeding ewes, the lambs of the spring crop and the yearlings are kept in separate flocks. The ewes are allowed to graze without reference to whether infection is present in the fields or pastures used. The lambs are kept, however, only in fields which have been plowed and planted with appropriate foliage crops since their previous occupancy by sheep, and are changed to fresh fields as the grazing becomes exhausted. They may remain in one field for several weeks or months. This practice is continued throughout the following year, and they are similarly handled the autumn of the next year as yearlings, after which they are handled as breeding ewes. Beginning about May 15, the lambs and yearlings of the year before (now yearlings and two-year-olds respectively) are dosed once a month until September 15 with 50 to 100 c.c. of one per cent. copper sulphate solution, meanwhile being changed from time to time to fresh grazing as the forage crops develop. The lambs from the breeding flock are dropped in April. Until about June, when the first forage crops become available, the lambs are kept in the stable. The ewes are turned out daily on stubble fields or similar pasturage, being brought to the stable at noontime to allow the lambs to suckle, and are also kept with the latter in the stable at night. The manure is removed from the stable about once a week. About May 15 the ewes receive a dose of 100 c.c. of one per cent. copper sulphate solution, and thereafter until September 15 are similarly dosed once a month. When the pasturage prepared for the lambs becomes available in June they are turned out daily and grazed between hurdles or portable fences, a fence in front and a fence behind, being moved to a fresh area every two or three weeks. At noontime they join the ewes in the stable, go back to pasture in the afternoon, and are kept with the ewes in the stable at night, so that they are with the latter during a period at noon and during the night, at other times being kept separate. Late in July or early in August the lambs are weaned and afterwards stabled and pastured entirely apart from the ewes. The two or three weeks' shifting of pasturage is continued until about the middle of August, when the lambs are turned into the corn field, and a month or so later they are placed in a field or fields which have been plowed and planted to a suitable forage crop at the proper time to be ready for them. After this the lambs are handled as yearlings. Under this method it will be noted the lambs receive no medicinal treatment, the treatment of the ewes, and the rotation of the pasturage being depended upon to prevent stomach worm trouble among the lambs. This method has also served to protect against trouble with other internal parasites as well as stomach worms. Complete freedom from stomach worms and other parasites has not been secured but the degree of infection has been exceedingly slight. The scheme outlined above may seem troublesome but it has not proved particularly difficult to follow. Further investigation may enable us to correct defects in this methods, as well as to simplify it and make it more practicable, and we are encouraged in believing that we will finally be able to outline a definite scheme or schemes for handling sheep that can be depended upon to prevent losses from stomach worms and that at the same time will not be expensive or unduly troublesome."

MISSENARD (R.). **Plaies d'été avec complications pulmonaires.** ["Summer Sores" with Pulmonary Complications.]—*Bull. Soc. Cent. Méd. Vét.* 1918. Dec. 5. *Rec. Méd. Vét.* 1918. Dec. 30. Vol. 94. No. 24. pp. 490–491.

The author records the case of a horse affected with two large sores on the facial region. In spite of local treatment the sores continued to increase in size, became covered with fibrinous or calcaro-fibrinous crusts about the size of split peas, and caused great irritation. The

general condition of the animal became very poor, the temperature varied from 37·5° to 39° C. and the breathing became irregular and dyspnoeic. Percussion of the chest revealed dullness of the superior parts of both lungs and auscultation almost complete cessation of vesicular murmur in their upper and anterior portions.

The animal was then slaughtered and on post-mortem examination the whole of the skin and subcutaneous connective tissue of the face was found to be indurated and inflamed whilst the underlying muscles remained intact. The pleural surface of the lungs was of a dull grey colour and of a "downy" appearance. On palpation innumerable nodules were found in the upper and anterior portions of the organs, laying just underneath the pleura. A small number were also found deep in the interior of the lungs. These nodules were formed in the substance of the lung and on incision small caseous masses similar to those found on the facial sores were encountered. Some of these were calcified. These small masses were contained within smooth-walled cavities surrounded by a zone of inflamed parenchyma which had become partly fibrous and adherent to the surrounding tissues. Some more or less diffuse inflamed patches were found in both lungs. The bronchial and submaxillary lymphatic glands were enlarged and inflamed but no visible lesions were found in the digestive tract. In this case a pulmonary metastasis had thus appeared to have taken place from the original facial summer sores.

DALRYMPLE (W. H.). **Note on the Occurrence of *Filaria papillosa*.**—*Jl. Amer. Vet. Med. Assoc.* 1919. Feb. Vol. 54. (New Series. Vol. 7.) No. 6. pp. 643–647.

In this short note the author records the occurrence of *Filaria papillosa* in the aqueous humur of a horse's eye in the United States of America. About nine days prior to its extraction it was observed by the owner to be about $\frac{1}{16}$ of an inch in length. At the time of operation, however, it appeared to be fully developed, about 50 mm. long and it was probably a male parasite. A very interesting short historical account of the incidence of this parasite is given.

SCHWARTZ (Benjamin). **Observations and Experiments on Intestinal Trichinae.**—*Jl. Agric. Res.* 1918. Nov. 25. Vol. 15. No. 8. pp. 467–482. With 3 text figs.

Inasmuch as little is at present known concerning the physiological processes of trichinae during the period of their growth in the small intestine it appeared to the writer that observations and experiments on the intestinal forms, with special reference to their behaviour under various conditions, might yield some useful information. The present paper embodies the results of this work and also includes observations on the moulting of the larvae *in vitro*, a phenomenon which does not appear to have been hitherto recorded. For the purposes of his experiments the author utilised albino and hooded rats which were artificially infected by feeding on ground up trichinous pork. The following summary and conclusions are drawn by the author as the results of his experiments.

"(1) The larvae of *Trichinella spiralis* do not linger in the stomach of the host after they are freed from their capsules, but pass into the small intestine.

"(2) The passage of the larvae through the stomach does not stimulate them to further growth and development, and a brief sojourn in the intestine is insufficient to initiate those processes which lead to sexual maturity.

"(3) Larvae from the intestine that have not yet been stimulated to further development become tightly coiled when removed from the host and placed in physiological salt solution, but those which have been stimulated to development apparently lose the power of becoming tightly coiled under similar conditions.

"(4) Larvae which have been stimulated to further development in the intestine will molt even after being removed from that organ. The molting process may be hastened by high temperatures and suppressed by low temperatures.

"(5) Larvae which have not yet been stimulated to further development in the small intestine can not be caused to molt by a high temperature.

"(6) With the beginning of development in the small intestine the larvae lose the power of surviving for considerable lengths of time outside of the host. They afterward become more persistent, however, in direct proportion to their increasing age.

"(7) When removed from the host within 24 hours after artificial infection intestinal trichinae often undergo spontaneous disintegration which may be due to the sudden change of environment, lack of food, or possibly the liberation of toxic substances which affect the parasites while in an artificial medium.

"(8) Larvae which molt after removal from the host have been observed occasionally to decrease in size. It is suggested that the dwarfed condition is possibly due to lack of food.

"(9) After the first and subsequent molts the tolerance of the larvae to various toxic agents is replaced by a marked sensitiveness to such agents which decreases, however, with advancing age.

"(10) Under the influence of potassium cyanid the worms undergo disintegration and exhibit susceptibility to the poison along the major axis which in the growing forms appears to be greatest in regions where growth takes place most rapidly.

"(11) Modifications in the permeability of the cuticle do not appear to be directly responsible for the changes in susceptibility. The changes probably result from a reorganization of the protoplasm coincident with growth, differentiation and age.

"(12) Attempts to induce molting in the larvae which have been decapsuled by artificial digestion and afterwards kept *in vitro* under various conditions have thus far failed to yield successful results."

CIUREA (Joan). **On the Possibility of the Infection of Pigs with the Flukes** *Opisthorchis felineus*, *Pseudamphistomum danubiense*, **and** *Metorchis albidus*.—*Ztschr. f. Fleisch. u. Milchhygiene.* 1916. Aug. 1. Vol. 26. No. 21. pp. 323–326. [Extract in *Int. Rev. Sci. & Pract. Agric.* 1917. Jan. Vol. 8. No. 1. pp. 96–97.]

"To decide the possibility of infecting pigs with these flukes, experiments were undertaken in 1914 and 1915. The author gave different fish containing larval stages of *Opisthorchis felineus*, *Pseudamphistimum danubiense* (especially in tench) and *Metorchus albidus* (especially in roach) to young pigs.

"First of all he gave to a 3 month old pig, for 55 days, in all: 40 tench (*Tinca tinca*)—8 common bream (*Abramis brama*)—1 Rudd (*Scardinius* (*Leuciscus erythropthalmus*) and 1 *Aspius aspius*. Dogs and cats were used as controls, being also given tench and roach. In the post-mortem examination of the pig, the author only found 7 adult *Opisthorchis felineus* (7 mm. long by 1·48 mm. broad) in the gall bladder and bile ducts. The control animals, which had been given fewer tench than the pig, contained several *Opisthorchis felineus* and a large number of *Pseudamphistomum danubiense*. The fact that no specimens of *P. danubiense* were found in the pig's liver seemed strange, since according to

the writer's experiments the roach (*Cyprinus*) and especially the tench in the Danube are more frequently parasitised by *P. danubiense* than by *O. felineus*.

"A second experiment was therefore commenced by giving to another pig for 71 days, in all: 93 tench—13 roach (*Blicca bjorkna*) and 2 bream. The autopsy showed that the bile ducts were thickened and full of a greenish-grey, glairy liquid. In the liver of the pig were found 45 adult and 2 immature specimens of *Opisthorchis felineus* and one adult but not mature *Metorchus albidus*. The parasites had developed normally. The liver of this second pig also contained no *P. danubiense*. On the contrary, the controls (dogs) of the second experiment contained as well as specimens of *Opisthorchis felineus* and *Metorchus albidus* some specimens of *Pseudamphistomum danubiense*.

"Conclusions.—(1) *Opisthorchus felineus*, and probably *Metorchus albidus* as well, can live as parasites in the liver of the domestic pig.

"(2) It may be that the pig is not parasitised by *Pseudamphistomum danubiense*, but further experiments are necessary to decide this question.

"(3) The presence of abnormally developed specimens of *Opisthorus felineus* and *Metorchis albidus* in the liver of the domestic pig may perhaps be explained by the fact that the latter is not the final host of the Distomata in question."

ACKERT (James E.). **On the Life Cycle of the Fowl Cestode, *Davainea cesticillus* (Molin).**—*Jl. Parasitology.* 1918. Sept. Vol. 5. No. 1. pp. 41–43. With 1 plate.

Of the six species of tape worms recorded from chickens in the United States the life history of only two has been demonstrated experimentally. *Davainea progrottina*, Davaine, is transmitted by the slug *Limax cinereus* Lister according to GRASSI and ROVELLI (1899 & 1892), and *Choanotaenia infundibuliformis* Göeze may have the house fly *Musca domestica* Linn. (GUTBERLET, 1916) as its intermediate host.

In this preliminary communication the author briefly describes some experimental work which goes to show that the house fly may transmit to chickens the tape worm mentioned in the title of this paper. The flies were fed on the onchospheres and portions of teased gravid proglottids and then as soon as the flies died they were given to young chickens reared in a fly proof chicken cage. The cestodes were subsequently discoverable in the intestinal tract of the birds thus fed.

MYCOTIC DISEASES.

NÈGRE (L.) & BOQUET (A.). **Essais de sérotherapie d'une affection mycosique chronique (Lymphangite épizootique des solipèdes).** [Experiments on the Serumtherapy of a Chronic Mycotic Affection (Epizootic Lymphangitis of Solipeds).]—*Ann. Inst. Pasteur.* 1919. Apr. Vol. 33. No. 4. pp. 269–274.

During the course of the year 1917 the authors carried out some incomplete experiments on the treatment of epizootic lymphangitis with a serum obtained from a sheep inoculated with increasing doses of non-pathogenic yeasts (*Saccharomyces ellipsoïdeus*). Interesting results are stated to have been obtained but nevertheless one of the horses treated with large doses of this serum (40 to 80 c.c.) repeated

every two or three days became so emaciated within a week that after having shown some improvement in the state of its lesions it had to be slaughtered.

LATOUR has recently recorded good results following upon the treatment of a number of affected animals with the serum of a horse that had recovered. The number of cures exceeded 35 per cent., and large doses—150 c.c. every four or five days subcutaneously—were recommended. The experiments recorded by the authors in this paper do not entirely confirm the conclusions of LATOUR and thus a satisfactory treatment for epizootic lymphangitis still remains to be found.

A horse was hyper-immunised with gradually increasing doses of cryptococci cultivated according to the technique already described by the authors [see this *Bulletin*, 1914, Vol. 2, p. 152; 1915, Vol. 3, pp. 71 and 111; 1917, Vol. 5, p. 116; 1918, Vol. 6, pp. 107 & 174]. The hyper-immunising process extended over a period of 118 days, during which time 11 subcutaneous injections were given commencing with 0·05 gramme of dead agar culture and ending with 4 grammes of living culture. The horse was bled a fortnight after the last injection. The injections provoked large swellings and abscesses which discharged from the 6th to the 10th days and healed up in a few days. A temperature reaction reaching 3° C. was observed after the injection of the larger doses and this commenced a few hours after the injection and lasted up till the end of the 3rd day.

The injection of large doses (25–40 c.c.) subcutaneously of the anti-cryptococcic serum thus obtained, repeated at intervals of 24 to 48 hours, produced in animals affected with the natural disease an improvement of short duration during the first days of the treatment, followed by distinct exacerbation of the symptoms manifested by the appearance of fresh ulcers and increasing suppuration. The serum appeared to bring about a rapid shedding of the buds and a marked inflammatory re-action at the seat of the lesions. However, it was not capable of arresting the continued progress of the disease.

Three severely affected horses were treated; one of these died during the treatment, the condition of the other two became gradually worse and the injections were discontinued. The effects of the serum treatment seemed to resemble that observed following upon injection of the antigen.

The two surviving horses were thereafter treated with small gradually increasing doses of serum intravenously. One of the animals showed very widespread lesions which had caused almost complete ulceration of the skin covering the right hind leg. It died as the result of a generalised secondary infection after an unsuccessful treatment extending over three weeks. The remaining horse, which had suffered for nearly ten months with severe generalised epizootic lymphangitis and had gradually become worse under other methods of treatment, was considered to be in a condition necessitating slaughter. The treatment extended over 32 days and comprised seven injections, commencing with 1 c.c. and ending with 15 c.c. Suppuration increased during the first day of treatment and new buds appeared which commenced to fluctuate after 48 hours and discharged. After the third day the large indurated masses found on the ribs and neck and the corded lymphatics began to diminish in size; cryptococci gradually

disappeared from the pus, and long standing ulcers rapidly cicatrised. Six weeks after the commencement of the treatment the general condition of the animal was excellent and suppuration had nearly entirely ceased; the smaller ulcers (1 to 2 cm. in diameter) were cicatrised and the large granulating sores were becoming gradually covered over with epidermis.

The interpretation of these results, the authors believe, is analogous to that suggested by METCHNIKOFF and BESREDKA to explain the phenomena following upon the treatment of lepers by increasing doses of a haemo- or leucotoxic serum. The action of such sera is due not to the products of the leprosy bacillus but to cytotoxins which, when injected in suitable doses, set up an intensified phagocytosis, which reveals itself by increased suppuration and rapid elimination of the organisms. Massive doses of anti-cryptococcus serum would thus set up a transient leucocytary action of excessive intensity, which would favour the multiplication of the cryptococci. Intravenous injections of very small and increasing doses of the same serum practised at suitable intervals not only exert an influence on phagocytosis but in addition stimulate the digestion of the parasites ingested by the leucocytes.

BOQUET (A.) & NÈGRE (L.). **Polymorphisme et déterminisme morphogénique du Cryptocoque de Rivolta.** [Polymorphism and Determination of Morphogenesis in Rivolta's Cryptococcus.]—*Ann. Inst. Pasteur.* 1919. Mar. Vol. 33. No. 3. pp. 184–190.

In the course of their researches upon the cultivation of the organism of epizootic lymphangitis the authors noted the polymorphic characters displayed by this organism. In this paper a description of the artificial media found to be most favourable for the development of the fungus is given and a study made of the phenomena of variation and of their physico-chemical causes.

It was found that when the temperature at which the media are incubated is lowered to 15–18° C. the parasite develops as a cylindrical mycelial organism which becomes more and more elongated. Its absorptive surface grows in proportion to its volume and the enveloping membrane becomes thinner.

When the temperature is raised up to an optimum of 35° to 36° C. and the cells are more completely bathed in a liquid which permeates them throughout they take on a spherical or ovoid form (yeast-like forms) and become surrounded with a double-contoured membrane. The temperature acts both on the medium, by modifying osmotic pressure, viscosity, and superficial tension, and also on the cells by exciting up to the highest degree the zymotic functions of the protoplasm.

The peripheral membrane seems to act as an organ for the regulation of nutritional exchanges. It increases in thickness and becomes doubled or it becomes thinner according to the degree of intensity of the physico-chemical factors governing development.

In the body of the horse under experimentally reproduced chemical influences such as the action of citric acid the dimensions of the yeast-like forms diminish, their absorptive surface grows in relationship to the volume and the doubly-contoured membrane persists.

Reproduction by budding takes place independently of aerobic conditions.

CURASSON (G.). **Une maladie du dromadaire analogue au farcin du bœuf.** [A Disease of the Dromedary Analogous to *farcin du bœuf* (Bovine Streptothricosis).]—*Bull. Soc. Cent. Méd. Vét.* 1918. Dec. 5. *Rec. Méd. Vét.* 1918. Dec. 30. Vol. 94. No. 24. pp. 491–496.

The affection named above was first noticed by the author in 1917 among dromedaries belonging to a Moorish tribe. Another herd of camels affected with the same disease came under his observation during the following year, and the symptomatology and etiology of the condition were then studied.

In the 18 animals observed the symptoms were alike and invariably chronic. The lesions were well-marked in all these animals submitted for examination and consisted of swellings varying in number and size, generally from 10 to 20 cm. apart and from the size of a walnut to that of a fist. These were found on the inner surfaces of the thighs, along the jugular furrows, sometimes on the inner surfaces of the forearm, rarely behind the shoulder, and never on the lower parts of the limbs or on the back. These presented the same characters as ordinary subcutaneous so-called "cold" abscesses. The largest number of swellings found inside the thigh of an animal was five, the average was two or three. Sometimes they seemed to be united with the neighbouring lymphatic gland by means of a corded lymphatic vessel which was not very prominent and was painless. The prescapular and inguinal glands became indurated and enlarged and afterwards showed the same characters as the local swellings. Subcutaneous rupture of the abscesses was never observed, but they are invariably punctured by the camel men themselves before this would naturally have taken place. The general condition of the animals appears to be unaffected by these lesions but it is asserted by the natives that when the disease affects young camels rapid loss of condition, and sometimes death, takes place.

These swellings are very slow in development and are not opened by the camel men until they have been in existence for about four or five months, when signs of fluctuation commence. Subsequently, recurrence of the lesions is almost constant and they persist although emptied on several occasions right up to the time of death of the animals.

The nature of the lesions was studied in the case of one animal slaughtered as the result of a compound fracture. Each cavity was separated from the neighbouring tissue by a fibrous wall from one to three cm. in thickness, yellowish-white on section, and not easily separated from the subcutaneous connective tissue which had also undergone chronic inflammation. The internal surface was covered with small granulations which were not very vascular. The pus was thick, glutinous, odourless, white, often clotted but rarely caseous. It was very different in appearance from the ordinary wound pus of the dromedary which is, as a rule, very liquid and has a distinct odour. The affected lymphatic glands had become completely converted into abscess cavities similar to the local lesions; the affected lymphatics took the form of large cords with ill-defined margins and consisted of a wall and contents similar to those of the glandular lesions. No visceral lesions were observed. The author was equipped with a few laboratory

materials for the study of the second outbreak and succeeded in isolating a streptothrix-like organism which seemed to be the causal agent.

In smears of pus one found almost constantly small mycelial masses which were Gram-positive. Towards the centre of each mass the filaments had become so entangled as to form an almost opaque dark violet nucleus, from which radiated two varieties of filaments, viz., (1) short thick deeply-stained straight elements, slightly swollen at their free ends and (2) much finer and much longer tortuous elements of uniform thickness which became branched and intermingled with each other and terminated in a thin pointed extremity.

The author was able to use the following media for cultural examination of the organism, viz., Martin's broth, broth made from commercial meat extract, milk, coagulated ox serum, and the so-called "palm cabbage." These cultures were incubated at about the body temperature. In two out of 10 tubes of Martin's broth inoculated with pus from a swelling there appeared on the surface on the 5th day small greyish, downy, and irregular masses. On the 8th day they became united but did not adhere to the walls of the tube. Microscopic examination of the growth showed organisms similar to those seen in the pus. The filaments appeared to be more slender and less branched.

In ordinary broth growth seemed to be more rapid and abundant. In one tube the particles became deposited quickly; the broth did not become turbid.

Milk appeared to be less suitable for growth. It was not coagulated. A stab culture in coagulated serum showed colonies in the form of greyish-white irregular compact-looking masses. The palm cabbage, which makes a very suitable culture medium, was utilised in the same way as potato. Growth on this medium was more abundant and the single colonies were larger. The surface of these masses was yellowish whilst they were almost brown towards their centres.

Animal inoculation.—Two dromedaries that were already affected with these swellings were inoculated subcutaneously on the inner surface of the thigh with pus from the lesions situated elsewhere on their bodies; no lesion developed at the seat of inoculation for up to one month afterwards. Out of seven healthy animals inoculated with diluted pus and five with an emulsion of culture, subcutaneously, three subsequently showed small nodules which developed in 20 to 25 days and contained purulent material in which the fungus could be seen. Two of these animals were inoculated with culture and the third with pus. Measures were taken so as to exclude natural infection of these animals after the inoculations.

A zebu and an ox inoculated subcutaneously with diluted pus and with broth culture subsequently showed no lesions.

Out of three sheep inoculated subcutaneously with diluted pus two subsequently showed at the seat of inoculation small abscesses which appeared on the 8th and 10th days and opened spontaneously on the 30th and 36th days, respectively. The organism was recovered from these abscesses.

A rabbit inoculated with pus subcutaneously developed a small abscess which formed slowly and had not ruptured at the end of a month. On the other hand intraperitoneal injection of the same dose of material gave negative results in the case of two rabbits.

No reaction was observed in the case of the monkey.

From the foregoing it would appear that the causal agent of this camel affection is a mould. The mode of entry of this organism is not understood. It does not appear to gain access to the subcutaneous tissues through wounds in the skin inasmuch as the lesions are never observed to arise in connection with such abrasions as harness wounds. The Moors incriminate a number of flies, especially Stomoxys.

With regard to the diagnosis of the condition the author asserts that there is in the Sahara regions of French Sudan at least one disease, known as *el bareda*, in which is seen a series of small bead-like swellings along the course of the jugular furrows. This disease develops rapidly, is of a less contagious nature and produces a high mortality. The lesions are, moreover, different—small fluctuating swellings which develop rapidly. It is possible that tuberculous lesions might develop in the form of subcutaneous cold abscesses in camels, but a microscopic examination of the pus and the tuberculin test would enable one to differentiate the condition.

In the case of individuals the prognosis is comparatively benign. It is far more serious in a herd or caravan on account of the risk of spreading the infection.

At the beginning of the affection the Moors apply to the swelling in this condition as well as in *el bareda* either the milky juice of a species of Euphorbia, fermented camel urine or plaster made from a brittle stone known as *hemmiro*. These substances produce no effect except perhaps in the case of the Euphorbia juice which acts as an irritant and hastens the development of the lesions; it is employed by the natives in the case of epizootic lymphangitis also for this purpose. When the swelling is well formed it is opened by means of a red hot knife and the applications of *hemmiro* are continued. Recurrences occur almost constantly.

In the case of the first herd upon which the author made his observations the abscesses were treated in the following manner. They were first opened boldly by means of a cautery, washed out by means of 5 per cent. copper sulphate solution, the walls of the abscess were lightly cauterised and a crystal of copper sulphate deposited within the cavity. Two of the eight animals thus treated subsequently developed recurrent abscesses. The same treatment was employed in the case of the second herd but the author was unable to prolong his observations sufficiently to estimate the value of the treatment.

The administration of potassium iodide in doses of first 15 grammes and then 10 grammes for a period of three weeks produced no improvement in the case of two animals.

[An editorial footnote states that this disease is probably identical with the condition known as "Jhooling" or "Jhoolak" in India, recently described by Cross (see this *Bulletin*, 1918, Vol. 6, No. 1, p. 43).]

Mason (F. E.). **Pseudo-Actinomycosis or Streptotrichosis in the Camel.** —*Jl. Comp. Path. & Therap.* 1919. Mar. Vol. 32. Part 1. pp. 34–42. With 4 text figs.

In February 1917 the author received for examination lesions, bearing a naked-eye resemblance to tuberculous lesions, from a young recently

imported Sudanese camel which had died after a short illness at Cairo. The lungs contained solid irregularly shaped masses up to the size of a broad bean and surrounded by a haemorrhagic zone. Innumerable semi-translucent spherical nodules resembling young tubercles were scattered fairly uniformly throughout the tissue of both organs. The bronchial, prescapular and lumbar glands contained yellowish-grey nodules. The kidneys contained numerous yellowish-grey firm areas chiefly in the cortex and mostly wedge-shaped on radial section. The liver also contained a few nodules with similar characters but approaching the spherical in shape.

Scrapings made from the various lesions enumerated were found on microscopic examination to contain a streptothrix fungus which was also obtained in pure culture from several of the lesions in the different organs. It bore a close resemblance to the active vegetative elements of the genus *Nocardia* (Actinomyces) and more particularly to *N. convoluta* Chalmers & Christopherson, 1916, from which, however, it is distinct. The fungus consisted of a mycelium composed of irregularly branching hyphae without visible sheath or segmentation. The hyphal threads were frequently of great length but about the same width as the tubercle bacillus. When stained by Gram's method the hyphae sometimes stained homogeneously but frequently they had a beaded appearance. Many short threads were seen, bacillary in form, some beaded and some uniformly stained. Apparently the beaded bacillary forms represented thallospores. In lesions above those of the smallest size the substance of the hyphae tended to break up into minute granules ; empty sheaths were also seen which no longer retained Gram's stain. In many of the hyphae, in which the method of branching off was irregular and not dichotomous, fusiform enlargements were seen measuring about 1·5μ in length by 1μ in width, chiefly placed lengthways in the course of a hypha. Sometimes they were placed at the point of origin of a branch and more rarely in a terminal position, giving a somewhat drumstick appearance. They were strongly Gram-positive and appeared to represent arthrospores. Free spores were also numerous. No club formation, rosette, or " grain " was discoverable by the naked-eye or microscope. In the absence of a so-called " grain " the fungus could not be classified as a Nocardia or true Actinomyces, but should be placed in the genus *Streptothrix* in which it forms a species with special characters apparently differing from all previously described pathogenic streptothrices.

A minute description is then given of the staining reactions and cultural characters of the organism and the pathological changes set up by it.

Experimental inoculation.—A guinea-pig inoculated subcutaneously with pure culture died on the 7th day and on post-mortem examination showed at the seat of inoculation a local inflammation and the presence of a thick cheesy material ; there was enteritis and the liver, spleen, lung, and kidneys were congested. The fungus was discoverable in smears from the local abscess and in blood from the kidney.

A white rat inoculated subcutaneously with pure culture remained apparently healthy for 30 days except for the formation of a small local swelling. On the 33rd day it died from other causes. At the seat of inoculation an abscess was found containing a thick sticky

cheese-like pus but no living organism could be found and cultures failed. Apparently the rat resisted infection.

Two camels were inoculated by scarification of the skin and rubbing in pure culture, the seat of inoculation being afterwards covered with sterile cotton. No reaction took place and the scarified areas healed rapidly. Two camels were inoculated intravenously with 1 c.c. each of pure culture emulsion in normal salt solution. One camel developed at the seat of inoculation over the jugular vein, apparently as the result of the escape of some of the liquid into the surrounding tissues, a slowly forming abscess which burst spontaneously on the 18th day. The pus on examination was not found to contain living Streptothrix filaments but only acid-fast spores. There was much granular detritus and unstained dead filaments. Cultures on agar grew well and typically on the 4th day. On the 51st day this camel was slaughtered, in good general condition. The lungs were found to be filled with nodules similar to those described in the naturally occurring cases, these nodules being surrounded with fibrous tissue. The bronchial glands were haemorrhagic but showed no definite lesions. The liver contained two nodules. The other organs were normal. Preparations made from the lung and liver lesions showed the acid-fast Streptothrix in great quantity and the organisms were grown on culture media with typical appearances.

The second camel beyond a transient temperature reaction showed no reaction to the inoculation. There were no local abscesses. It was slaughtered on the 51st day and a careful examination failed to reveal any lesion due to the Streptothrix.

A second case of the natural disease was found in June 1918. The lungs of an Egyptian camel slaughtered for debility were found to contain, in addition to numerous tubercle-like nodules, patchy areas of pneumonia following the distribution of the lobules, and a lesion containing a cheesy mass as large as a walnut. The bronchial glands were caseous. The lesions disclosed an acid-fast Streptothrix which was morphologically and culturally identical with that found in the first case.

Of the two cases described above the oldest lesions in the first are stated to be undoubtedly those in the lungs and in the second case the lesions were limited to those organs and their glands. This fact taken into consideration with the complete desiccation which the spores are able to withstand, as shown by the author's experiments *in vitro*, suggests that natural infection takes place by inhalation of the spores. It is further suggested that the Streptothrix has its habitat outside the animal body, probably as a parasite on a cereal or grass, which when dried would reach the required degree of desiccation for the liberation of the minute spores.

In a report, dated March 1908, and entitled "Veterinary Notes on Kordofan Province, WILLIAMS (A. J.), shortly described a lung disease of camels, locally called "Guffar" or "Ghudad," in which tubercle-like lesions were found in the lungs. [In a footnote the author states that in Egypt, Palestine and Syria "Guffar" or "Jaffar" is one of the names for trypanosomiasis.] WILLIAMS states, however, that examination of specimens at the Khartoum Laboratory showed that the disease was caused by a Botryomyces, and not by a Streptothrix.

Mason believes that he has described a streptothricosis or pseudoactinomycosis in the camel caused by a species of Streptothrix which has not previously been recorded and he therefore proposes to name it the *Streptothrix cameli.*

BACTERIAL DISEASES.

VELU (H.). **Le charbon bactéridien au Maroc.** [Anthrax in Morocco.] —*Bull. Soc. Path. Exot.* 1919. Mar. 12. Vol. 12. No. 3. pp. 126–127.

CHAUVEAU'S researches showed that Algerian sheep were resistant towards the anthrax bacillus of French origin. This conclusion has wrongly led to a belief among agriculturists that anthrax in the sheep did not exist in Algeria. The recent work of LÉHRITIER, FLÉRY and TRIBOUT (1912) has shown that the disease can be observed among Algerian sheep and that death is produced under conditions similar to those observed in outbreaks among French flocks, but the bacillus of Algerian origin is endowed with greater virulence than the French organism. MARIN and HENRY (1916) have shown that anthrax is not rare in the region of Constantine but outbreaks become manifest under atypical fulminant forms which render diagnosis very difficult.

Anthrax is common in Morocco and has been recorded by veterinarians as being widespread in many districts. It is well known by the natives, but, as in Algeria, it is often mistaken by even enlightened Europeans. It makes its appearance after the harvests at the time when land upon which cereals have been cultivated is turned into pasture. Isolated cases of the disease occur very frequently but it may become more or less epizootic in character although this is somewhat rare; this circumstance was observed in the case of cattle imported in 1913 and 1914 from Argentina and Portugal for the needs of the army of occupation. In such instances deaths occur regularly as in a true epizootic but several days may elapse without observing a single death and then the disease re-appears. It always runs a hyper-acute course lasting only a few hours. The affected animals show only a few ill-defined symptoms. On post-mortem examination no lesions are often to be found. The spleen may be just appreciably enlarged and some petechiae may be seen on the serous membranes. At the Casablanca abattoir EYRAUD was able on several occasions to diagnose anthrax in cattle and sheep which showed only a few interstitial haemorrhages.

The above hyper-acute form of anthrax has been observed in horses as well as in cattle. Microscopic examination systematically carried out enabled the author to discover the rôle of the anthrax bacillus in certain diseases of a fulminant character appearing in the form of an epizootic among flocks of sheep, where the disease would not have been suspected on clinical or post-mortem examination.

WASHBURN (Henry J.). **Hemorrhagic Septicemia.**—*U.S. Dept. Agric., Bureau of Animal Industry, Bull. No. 674.* 1918. May. 15. 11 pp. 1918. Washington: Govt. Ptg. Office.

A general description of the history, cause, nature, and methods of controlling the disease as it affects the domesticated animals in the United States of America are given in this Bulletin.

Most of these facts are already well known. The methods recommended for prevention are worthy of note. It is stated that the domesticated mammals and fowls may be protected experimentally from contracting the disease by the use of "bacterins." Cattle, sheep, swine, rabbits, and fowls if treated with heated cultures of the specific organisms obtained from mammals or birds of the same species as that to which they belong will almost invariably become protected against injections of living cultures of the same organism, even though this may be injected in comparatively large quantities. Tests made by the Bureau of Animal Industry have shown that the use of cultures from animals of another species often affords similar complete immunity. Sheep are said to have been made immune against cultures obtained from other sheep by the use of cultures prepared from cattle. Rabbits were also made resistant towards haemorrhagic septicaemia cultures, derived from a variety of species of animals, by treatment with prepared cultures obtained from animals of other species. They were completely protected against the effects of inoculation with virulent cultures of the true *Bacillus bovisepticus* in doses four times as large as that required to produce fatal results in a rabbit receiving no previous treatment. Fowls were protected against injections of lethal doses of virulent fowl cholera organisms by the use of prepared bouillon growths of the same germ, or by the use of strains of the fowl cholera bacillus possessing but little virulence. However, when the colon or paratyphoid B group of organisms is found to be responsible for the deaths it is recommended that the bacterins should include these organisms.

As a result of these investigations and of the work of other authors several cultures obtained from a number of outbreaks of disease are at the present time employed for the protection of stock against the attacks of haemorrhagic septicaemia, the cultures being obtained from homologous species of animals.

Very satisfactory results are said to have followed the vaccination of sheep with attenuated cultures of the living organism. In one outbreak about 3,000 sheep were treated with this material. After 48 hours subsequent to vaccination of the flocks only nine sheep were lost although previous to inoculation several animals died each day. Bacterins made from the killed organisms of haemorrhagic septicaemia have also been used with considerable success in treating affected flocks of sheep in Oregon.

DISEASES DUE TO FILTERABLE VIRUSES.

REMLINGER (P.). **Immunisation du lapin contre l'inoculation sous-dure-mérienne de virus rabique fixe au moyen de cerveaux traités par l'éther.** [Immunisation of the Rabbit against Subdural Inoculation of Fixed Rabies Virus by means of Brains treated with Ether.]—*C. R. Soc. Biol.* 1919. Jan. 25. Vol. 82. No. 2. pp. 52–54.

The opinions of authors who have succeeded in vaccinating rabbits against sub-dural inoculation with fixed virus may be summarised by stating that this immunisation is difficult to accomplish, that it appears more often to be a chance occurrence than the result of a well-regulated technique, and finally that its duration is ephemeral. Remlinger now states, however, that his point of view has been somewhat modified since he has employed ether for the attenuation of the virus for vaccination.

Having established that when the brain of a rabbit dead of rabies is immersed in sulphuric ether the superficial layers become innocuous after 60 hours and the central parts after 120 hours the author inoculated in a certain number of successive doses, subcutaneously, into 47 rabbits from 100 to 1,000 c.c. of a 1/50 emulsion of brain material that had been kept in ether for a varying number of hours. A fortnight after the last inoculation the animals were tested as to the state of their immunity by sub-dural inoculation with ¼ c.c. of a 1/50 emulsion of fixed virus. In the case of a negative result the operation was repeated every month or two months with increasing doses of virus. Out of the above 47 rabbits 16 (34 per cent.) did not react to sub-dural inoculation. In 31 cases death occurred after inoculation with a delay, as compared with the controls, of one day (11), of 2 days (4), of 3 days (7), of 4 days (3), of 5 days (2), of 6, 7, 9, and 10 days (one each). In these partially immunised animals the symptoms were in the great majority of cases identical with those occurring in the non-vaccinated animals.

The author then gives the number of survivals after each repeated sub-dural inoculation. [The reader is led to believe that these last results would indicate the duration of the immunity conferred by the injection of the etherised brain material. It is evident, however, that survival from the effects of each sub-dural inoculation with untreated virus might considerably increase a rabbit's immunity. —ED.]

The principal factors influencing the production of immunity are then discussed. It was found that brain material that had been rendered almost or completely avirulent still gave a certain number of positive results. The more virulent the material used for immunising the greater would be the degree of immunity expected to be set up. The results in this connection, however, appeared at times to be a little capricious, although in the main they are stated to be regular.

The author concludes that the immunisation of the rabbit against sub-dural inoculation with fixed virus is easier to accomplish than has been hitherto admitted. It is certainly not obtained with a mathematical degree of regularity but it is, however, established according

to sufficiently well fixed rules. Once this immunity has been set up it remains remarkably solid and in most cases it cannot be broken down.

REMLINGER (P.). **Contribution à l'étude de l'immunité héréditaire contre la rage.** [Hereditary Immunity against Rabies.]—*C. R. Soc. Biol.* 1919. Feb. 22. Vol. 82. No. 4. pp. 142–144.

In the course of a study extending over about ten years on the above subject, almost invariably negative results were obtained by the author in the case of the rabbit, thus contrasting with the more encouraging results observed in the case of the dog by KONRADI [see this *Bulletin*, 1916, Vol. 4, No. 2, p. 62, and 1917, Vol. 5, No. 2, p. 118]. Even under the most favourable conditions (sire and dam immunised, immunisation conducted intensively during gestation) the animals were seen to succumb always to the effects of sub-dural inoculation, almost always to intra-ocular inoculation, and it was only exceptionally that the rabbits were able to resist the effects of intramuscular or subcutaneous inoculation.

The study was resumed with a pair of rabbits that presented exceptional characteristics, viz., one male endowed with an absolute natural immunity and another male completely immunised as the result of having recovered spontaneously from an attack of rabies conferred by sub-dural inoculation with fixed virus. In addition 10 male and female rabbits were vaccinated by means of material from rabid brains treated with ether and subsequently resisted the effects of four to seven sub-dural inoculations.

In preliminary experiments the sire alone was demonstrated to play absolutely no part in the production of immunity in the offspring, thus in further experiments both the sire and dam were or the dam alone was immunised. In three cases only test inoculations were performed sub-durally, this method being found to be too severe (three deaths); in four cases only the inoculation was intra-ocular (three deaths, one survival; identical results in controls).

Almost all the animals were tested by inoculation into the muscles of the neck, at the same time as control rabbits, with 2 c.c. of an emulsion of fixed virus 50 times diluted. If an animal survived it was inoculated with 10 c.c. into the neck muscles; and if it again survived with 20 c.c. of the same emulsion. It was finally submitted to sub-dural inoculation. In each experiment an equal number of controls, kept under identical conditions, was inoculated.

The results obtained appeared to confirm fully those obtained in the author's preliminary researches.

Thirty one rabbits, born of immunised parents, each received 2 c.c. of emulsion intra-muscularly; result, 21 survivors and 10 deaths (controls, 16 survivors and 15 deaths).

Twenty rabbits born of immunised parents, received intramuscularly in succession doses of 2 and then 10 c.c. of the 1/50 emulsion; result, 12 survivors 8 deaths; (controls, 10 survivors 10 deaths).

Twelve rabbits born of immunised parents received successively intramuscularly doses of 2, then 10, then 20 c.c. of 1/50 emulsion; result, 8 survivors and 4 deaths; 12 controls identically treated, 7 survivors and 5 deaths.

Finally, 8 rabbits born from immunised parents received successively intramuscularly 2, then 10, then 20 c.c. of 1/50 emulsion and were then inoculated sub-durally; result, 3 survivors and 5 deaths; 8 controls kept under identical conditions gave 2 survivors and 6 deaths.

From the above it may be concluded that rabbits even when completely vaccinated against rabies transmit to their offspring only a slight, irregularly occurring, and practically negligible immunity.

REMLINGER (P.). **Accidents paralytiques étrangers au virus, au cours de l'immunisation antirabique du Lapin.** [Paralysis arising independently of the Virus Inoculation in the course of Antirabic Immunisation of the Rabbit.]—*C. R. Soc. Biol.*, 1919. Mar. 15. Vol. 82. No. 7. pp. 254–256.

The paralyses which occur exceptionally in man whilst undergoing a course of anti-rabic treatment, or some time after the treatment, have been the object of numerous studies, and their significance has been interpreted in very remarkable ways. The author found that in the case of the rabbit the inoculation of an emulsion of homologous rabic brain material, treated or not treated by some attenuating agent, was capable of setting up paralytic symptoms even when given in small doses: in the production of these symptoms the virus itself could not be held responsible and they resembled very closely the accidents observed in man. Four such cases occurring in rabbits are described in detail. Except in the matter of severity, the paralyses seen in the course of anti-rabic treatment and those observed in the case of these rabbits were substantially of the same character. The paralyses resulting from treatment are almost always benign whereas the author's four rabbits died after a variable lapse of time; otherwise, both types of paralysis were similar in that they manifested a sudden onset, predilection for the hind legs, and absence of derangement in the general condition. In the case of the rabbits there was every likelihood of the paralytic symptoms having been set up as a result of the inoculation, as symptoms of a similar nature were never observed in rabbits bred at the Institute and not inoculated. Inasmuch as inoculation with the brains of these four rabbits failed to demonstrate the presence of the rabies virus one has to incriminate either a toxin or some poisonous substance present in the normal brain material, capable of acting in this manner on animals of the same species.

GRAY (C. E.). **Rinderpest Campaign in East Africa. Final Report, Rinderpest Commission.**—M.S. Received from the Colonial Office 7th March. 1919. 11 pp. f'cap.

After the departure of Colonel Gray for South Africa the work of the Commission was carried out by Captain GARDEN, Chief Veterinary Surgeon, Nyasaland. Three inoculation stations were established in the New Langenberg district to deal with the recurrent outbreaks of rinderpest; climatic conditions proved very unfavourable for the speedy execution of the work undertaken and in addition cases of rinderpest were found amongst cattle brought for inoculation from the Proto Hills and from the hilly country beyond the Kiwora River. The area in which inoculation had to be carried out had thus to be extended and it was decided to revert as soon as possible to the

original plan of campaign outlined in the first report [see this *Bulletin*, Vol. 6, No. 2, p. 115], viz., to establish an immune belt of cattle right along the whole of the Northern Rhodesian-Nyasaland Border; the appearance of the disease near Mbozi about 100 miles to the west of New Langenberg and of mortality among eland, bush pig, and wart hog in the Bukwa Valley close to the Belgian sphere of operations would necessitate the execution of this plan as rapidly as possible. The animals were returned to their owners immediately after inoculation. By the 6th May all the cattle in the New Langenberg district totalling 27,152 had been inoculated.

An inoculation centre was then immediately set up at Issoko for cattle in the Bendali district and for some of those from the Urambia district. 12,589 animals were here dealt with.

On the 12th May an inoculation camp was set up in the Urambia district where 6,440 head of cattle were dealt with. This camp was closed down on the 18th May and then the Commissioner proceeded to Mbozi. Several deaths had occurred among cattle at this place, some of which were suspected to be due to rinderpest though others were proved to have suffered from East Coast fever. Virus animals were brought in from the last established camp and 9,039 animals were inoculated here and in two adjoining villages.

Two inoculation centres were then set up in the Kasanga district bordering on Lake Tanganyika; the animals were kept in the concentration camps until the reaction had ceased, particularly on account of the scattered way in which the natives were living in this wide area and the difficulty of controlling movements of animals after leaving the station. Inoculations were then performed in the Namanyere district, the work involving 2,225 animals, which had been dealt with by the 10th July. A few animals were again inoculated in Kasanga and this concluded the formation of the immune belt beyond Lakes Nyasa and Tanganyika, a distance of 200 miles.

In the course of its operations the Commission inoculated nearly 100,000 head of cattle, all the property of natives, in the territory which had formed part of the German East Africa Protectorate. The results are stated, generally speaking, to have been satisfactory and the mortality was estimated not to have exceeded on an average 5 per cent. However, in a former report it was mentioned that at the New Utingulu camp the appearance of East Coast fever and redwater among inoculated animals caused a heavy mortality, and during the later operations of the Commission there was a heavy mortality from redwater amongst cattle inoculated in the Kasanga and in the Namanyere districts amounting to at least 20 per cent. In the vicinity of Mbozi a considerable number of calves died, many of which, it was subsequently discovered, were not brought in for inoculation and became infected later while the inoculated animals were reacting. In the Kasanga and Namanyere districts the high death rate was attributable to the use of virulent blood for inoculation taken from cattle immune to this disease, and to the susceptibility of the cattle in these districts.

Reports and rumours of relapses and recurrences of rinderpest among cattle bearing the brands of the Commission were investigated when possible. In some cases it was found to be probable that the cattle had died of rinderpest but in other instances death was found

to have been due either to malignant catarrh or to East Coast fever. The generally healthy condition of the large numbers of cattle at present found in some of the areas in which the Commission has worked is stated to be the most satisfactory proof that the results obtained have been as good or even better than anticipated. Localised recurrences or alleged recurrences may be attributed to frauds on the part of the natives, to the inadvertent use of blood for inoculation which had become avirulent (this is not regarded as being a likely contingency) and to the appearance of the disease among cattle inoculated originally with serum alone and subsequently not brought up for the simultaneous inoculation. Certain observers in India state that animals which have failed to exhibit any signs of reaction following upon the simultaneous inoculation do acquire an active and lasting immunity; on the other hand there were instances noted in East Africa of animals passively protected by massive doses of serum and afterwards inoculated by the simultaneous method which had retained their susceptibility to natural infection and therefore some breakdowns might be due to this cause [*see*, in this connection CROVERI'S experiments on the immunity of calves, p. 95.—ED.]. In any case the number of breakdowns reported was small and unimportant.

Owing to the temporary shortage of serum Garden resorted to the method of dealing with sucking calves, previously tried by German workers in East Africa, by means of which these animals received a dose of virus and were allowed to depend on their dams for protection simultaneously by way of the milk. "Fairly good results" are stated to have been obtained in this way.

With the completion of the task of establishing a belt of immune cattle along the border the work of the Commission draws to a close and it is anticipated that most of the personnel can be withdrawn at an early date. However, as the disease still exists to the north of the immune belt and the task of eradicating it there would be impossible it may be carried southward across the belt by cattle and game. In the case of game the danger has been greatly reduced by consistent destruction of all game found in the belt but there is a risk of disease being brought south by surreptitiously introduced cattle. Gray then outlines a scheme of protective measures which should be observed for another six months at least.

In a Supplementary Report, dated 21st December 1918, it is stated that rinderpest had by a stroke of misfortune again appeared in the belt described above. Four definitely diagnosed cases of rinderpest occurred among cattle surrendered by Germans and three suspected cases among cattle left by Germans at Kasama. All non-immunised in-contacts and all cattle inoculated with serum alone included in an area within a radius of 14 miles around the quarantine camp, South Abercorn, Kasama, were destroyed as a protective measure. The animals of the infected herd had travelled through Rhodesia, Fife, to Chambers River, South Kasama, and thence to Abercorn. These cattle were apparently brought by the German Commander Von Lettow from Mereres country immediately north of the immune belt established by the Commission. The evidence seemed to suggest that these animals had become recently infected. It is said, with regard

to the danger of the disease extending southwards from this centre of infection, that a good deal will depend upon whether the game picks it up as there are few cattle in the locality of the outbreak and none within four miles of the road along which the infected herd travelled. Unless the game carries the disease across the fly belts extending to the south there are good reasons for hoping that the present outbreak may be isolated and arrested. Difficulties were experienced on account of shortness of staff.

ADAMS (A. H.). **Report on a Small Outbreak of Rinderpest in British Somaliland.**—M.S. Received from the Colonial Office 22nd February. 1919. 2 pp. f'cap.

In this report the author describes an outbreak of rinderpest among 135 Somali cattle at Bir, British Somaliland, on the 2nd September, 1918, nine animals having died and 22 being sick. By the 14th of October the herd had become reduced to 21 head of cattle. The source of infection of this herd was not discoverable and there is no authentic record of any previous outbreak of rinderpest in the country, although the natives speak of having seen isolated cases. As a precaution against the spread of the disease the entire herd was at once isolated in two specially built zaribas situated at some distance from other cattle, one containing the apparently healthy animals and the other the diseased, and guards were placed to prevent any animal being taken away. The movement of all cattle throughout the country was stopped until the disease was well under control. Although other cattle were grazing on the same plain at the time of the outbreak no other herds became infected and movement of cattle was again permitted after having been suspended for fourteen days.

PIOT BEY. **Recrudescence de la peste bovine en Egypte. Extinction rapide d'un foyer par l'immunisation active des contaminés; innocuité absolue du sang pesteux contenant des piroplasmes utilisé au cours des vaccinations; susceptibilité des bovidés égyptiens à la peste bovine; persistance, au dela de cinq années, de l'immunité acquise a la suite des vaccinations antipestiques.**—*Ann. Inst. Pasteur.* 1919. March. Vol. 33. No. 3. pp. 197–207.

In a former communication (1916) the author reported to the *Administration des Domaines* the results obtained following upon the active immunisation of more than 2,000 cattle, and the Egyptian Government, with a view to the complete eradication of rinderpest from the country, had ordered the systematic and general application of the simultaneous method throughout the whole extent of the territory commencing with the cotton growing districts. Excellent results are stated to have been thereby obtained but the course of operations was interrupted by the outbreak of war in 1914. Thereafter either on account of the breaking out of the disease from foci that had not been completely extinguished, the importation of cattle from the Sudan, or the spread of the contagion along

the transport routes by these imported cattle, in spite of precautions taken, the disease re-appeared in 1916 in several Provinces in Upper Egypt and spread in 1917 over almost the whole of Lower Egypt.

Although there remained a considerable stock of serum prepared at the Abbasieh Institute, the source of virulent blood, which was obtained from cattle imported from Cyprus—these animals being rarely affected with piroplasms, had disappeared on account of the closing of the Institute. Rather than have recourse to the native cattle for obtaining virulent blood for inoculation the official State Veterinary Service had substituted friction of the muzzle, lips and gums with the discharges of affected animals on account of the risk, which was regarded as serious by KOCH, of setting up piroplasmosis by the inoculation of blood from these cattle. This method, however, in practice proved itself almost always to be ineffective inasmuch as after a few weeks rinderpest re-appeared in the herd thus treated.

In August 1917 the state with regard to rinderpest of the cattle possessed by the *Administration des Domaines* and distributed over about 40 farms situated in the centre of the Delta was as follows:—(1) about 1,400 adult cattle vaccinated in 1912 to 1914, (2) 281 adult and 395 young cattle from 2 to 3 years old purchased in 1916 and 1917 and not yet vaccinated. The young cattle were collected in herds of from 40 to 100 in seven of the principal farms. At this time numerous centres of disease cropped up rapidly in adjacent districts in the Delta.

The author then describes the treatment of the uninoculated animals by inoculation with serum and virulent blood in the scene of the epizootic. From the experience gained the author concludes that in an infected centre the simultaneous method of vaccination applied to all animals exposed to contagion is the most effective method of rapidly checking the spread of the disease by conferring upon these animals an absolute immunity. If a supply of serum is not available the isolation of each affected and each in-contact animal enables one immediately to extinguish the centre and thus establish a momentary security.

It was further shown that, contrary to the assertions of KOCH, the use of rinderpest-infected blood containing redwater parasites is in Egypt absolutely innocuous when used for vaccinating either young or adult cattle. A transitory rise in temperature, which might be attributed to piroplasmata, was obtained during the second fortnight after inoculation in some cases, but no other redwater symptoms were observed and blood examination gave negative results.

Only two cattle recently purchased succumbed to piroplasmosis and these cases probably arose independently of the rinderpest inoculation.

It was shown that the susceptibility of young cattle towards rinderpest in Egypt is almost absolute; it becomes less with advancing age and varies around about 50 per cent. among adults.

The statement is next repeated that artificial immunity possessed by both the parents appears to be transmissible to the offspring, but immunity of one parent only appears to have no influence upon the offspring. In this article the author records the case of a calf 28 days old, born of a cow vaccinated in 1914 by a bull immunised in 1915; the calf and its dam were submitted to the double inoculation

at the same time but no temperature or clinical reaction was subsequently observable in either case. In the author's former communication two experiments [only] were given to show that the immunity thus acquired from the dam alone was negligible.

Finally, it was found that the immunity resulting from the double inoculation can be shown by experiment to exist for up to three years and in practice for over five years.

CROVERI (Paolo). **Sull recettivita alla vaccinazione antipestosa dei vitelli nati da mare immune verso la peste bovina. Esperimenti di siero-vaccinazione antipestosa (methode KOLLE e TURNER in vitelli lattanti e dopo la slattamento.** [The Susceptibility of Calves born from Rinderpest-Immune Cows towards Anti-Rinderpest Vaccination. Experiments upon the Effects of Sero-Vaccination on Milk-Fed and on Weaned Calves.]—*Bull. Soc. Path. Exot.* 1919. Feb. Vol. 12. No. 2. pp. 65–71.

In this paper the author records a series of experiments upon the immunity towards rinderpest of sucking and weaned calves born from cows themselves actively immune towards that disease as the result of double inoculation. The results of these experiments can best be seen from the following table; the calves were inoculated in each case with anti-serum and with rinderpest blood of ascertained virulence. It is the custom in Italian Somaliland to allow calves the whole of their mothers' milk up to the age of three months, during the 3rd they receive a part only of the milk and during the 4th they are weaned completely. Calves No. 2, 6, and 9 were hand-fed with a beverage made from a mixture of various meals.

No.	Age.	1st vaccin. 5 : 10 : 17	2nd vaccin. 19 : 12 : 17	Remarks.
1	5 months ..	—	—	
2	4 mths. 15 days.	+	—	7 months calf. Mother died a few days after its birth.
3	4 months ..	—	—	
4	3 mths. 20 days.	—	+	Mother died a few days after 1st vaccination.
5	2 mths. 20 days.	—	—	
6	2 mths. 20 days.	+	—	Mother died as result of an accident towards the end of its period of gestation and the calf was extracted by Caesarian section. Pail fed with milk and an admixture of food as in case of No. 2.
7	2 mths. 10 days.	—	—	
8	6 months ..	—	+	
9	8 months ..	+	—	Without milk from the age of 3 months, living at pasture.

From his experiments and observations the author concludes that the milk of an actively immune cow is capable of maintaining the sucking calf in a state of passive immunity, which still persists when the calf is partially weaned. Calves fed artificially, especially on milk

substitutes, react to vaccination. The above passive immunity persists for some time after the calf has been completely weaned but not for a longer period than three months. Between the period during which the calf is certainly immune (that is, whilst sucking and for some little time afterwards) and the time when it is capable of reacting towards vaccination in the same manner as adult cattle there exists a period during which the calf is susceptible, but the persistence of a few anti-bodies in its blood causes the reaction to be of a very mild type, often difficult to detect, and manifested by a slight initial rise of temperature or slight lachrymation.

The practical inference to be deducted from the above results is that no calf under five months old should on any account be vaccinated. As a general rule vaccination should not be performed until the calves are seven months old. If, however, owners bring up calves for vaccination just over five months old one should advise them to keep a careful watch for symptoms of reaction as shown by depression, loss of appetite, lachrymation, and, should these signs be absent, to submit their animals for inoculation again at the age of seven months.

McArthur (Clifford L.). **Transmissibility of Immunity from Mother to Offspring in Hog Cholera.**—*Jl. Infect. Dis.* 1919. Jan. Vol. 24. No. 1. pp. 45–50.

The facts recorded in this paper may be of some importance for comparison with those obtained in the case of the offspring of rinderpest-infected cattle by Croveri and referred to in the preceding extract. The circumstances in the case of the young pigs studied in the present paper are analogous to those connected with the calves referred to above inasmuch as in both cases the mothers had been inoculated with virulent blood and specific anti-serum—the sows had been immunised by the Dorset-Niles method and the cows by the Kolle-Turner method. The following is the summary given in McArthur's paper.

"The results of these experiments would indicate that sows immunized against hog cholera by the Dorset-Niles method transmit this immunity to their offspring. In nearly every case the pigs retained their immunity as long as they were suckling and the sow was immune. When the mother contracted the disease the pigs did not usually survive more than a few days, and in some instances cholera lesions were found on necropsy.

"There seemed to be but little difference in susceptibility of these suckling pigs to different methods of exposure.

"The duration of immunity in the different pigs, after weaning, was only tested to a limited extent. From the data available, it is evident that different pigs vary, but in most cases the immunity lasted a few weeks after weaning.

"A number of pigs died in the different experiments without showing cholera lesions. Death in these cases was probably due to indigestion, worms, etc., and not to hog cholera.

"Second litters were as highly immune as the first litters in all cases, and in some instances even more highly immune while suckling.

"The method whereby the antibodies are transmitted from mother to offspring in hog cholera is more or less an open question. The fact that the suckling litters sicken as soon as the mother becomes infected, also, that immunity is gradually lost after weaning, would indicate that the antibodies are transmitted through the milk during the entire suckling period.

"Data were secured from 31 litters, covering a total of 179 pigs. Of this number 125, or 69·8 per cent. survived all treatment; 39, or 21·7 per cent., succumbed during the course of the experiments, but did not show cholera lesions on necropsy and 15 pigs, or 8·3 per cent., died showing cholera lesions. From these results it might be considered that 91·7 per cent. of the pigs were immune to hog cholera. It is entirely possible, however, that some of the pigs which died without cholera lesions were affected more or less with the disease, and that the percentage of pigs showing immunity would be less than 91·7 per cent."

PETIT (Henri). **Note sur la transmission de la fièvre aphteuse bovine à l'homme.** [Transmission of Foot-and-Mouth Disease from Cattle to Man.]—*Rev. Path. Comp.* 1919. Jan. Vol. 19. No. 152. pp. 7–8.

The author records an outbreak of foot-and-mouth disease towards the end of November 1918 occurring in a small village in the Belgian Ardennes. The inhabitants of this isolated locality were confined to the land cultivated by them. Five days after the commencement of the outbreak of foot-and-mouth disease among the cattle 20 persons out of a population of 300 became infected within three or four days. The onset of the disease was marked by headaches and fever usually accompanied by vomiting and in two cases by epistaxis. The temperature remained at between 39° and 40° C. for three days and then fell to normal in one or two days. More or less marked symptoms of stomatitis were observed from the commencement—a congested line along the gums, reddish points on the tip and along the border of the tongue, and slight reddening of the tonsils, accompanied by a very foul-smelling breath. Towards the third day of the disease small circular ulcers each surrounded by an inflammatory zone could be seen on the gums in three of the patients. All recovered in about a week. In the case of cottages in which the cows were not affected or the milk given to pigs the inhabitants did not become infected.

FINZI (G.). **Auto-vaccino-tossino-terapia nell'afta epizootica.** [Auto-Vaccine and Toxin Therapy in Foot-and-Mouth Disease.]—*Nuovo Ercolani.* 1919. Feb. 15. Vol. 24. No. 3. pp. 17–19.

The investigations of PERRONCITO, TERNI, and of the author himself are stated to have shown that the blood or blood serum of cattle that had recovered from a pronounced attack of foot-and-mouth disease exhibits well-marked preventive and curative properties against the disease virus even when exalted considerably in virulence. TERNI, moreover, showed that the blood serum obtained during the course of an acute attack or at the commencement of the convalescent period possessed no well-defined curative properties. It was shown by COSCO and AGUZZI and by TERNI that the blood was at its highest degree of virulence during the height of a febrile attack. In localities where foot-and-mouth disease had thus assumed a serious character the author attempted the following [somewhat extraordinary—ED.] treatment. Blood was withdrawn from the jugular vein of an animal by means of a sterile syringe during the febrile period of the disease and immediately injected subcutaneously at the base of the neck of the same animal. Adults received 150 c.c., yearlings 50–75 c.c., and sucking calves 20–25 c.c. In calves and yearlings especially a

marked general reaction manifested by a rise of temperature could be observed two or three hours after the injection, followed in from 6 to 12 hours by a very marked amelioration in the symptoms. Details concerning the results of this method of treatment are promised in a subsequent communication.

MACK (Winifred B.) & RECORDS (Edward). **The Control of Contagious Epithelioma in Chickens by Vaccination; Experiments in Nevada, U.S.A.**—*Univ. of Nevada, Agric. Expt. Sta.*, Bull. No. 84. 32 pp. With 19 figs. [Extracted in *Int. Rev. Sci. & Pract. Agric.*, 1917. Jan. Vol. 8. No. 1. pp. 97–98.]

In the State of Nevada, United States of America, there occurred during the winter of 1914–1915 a severe epizootic of fowl pox among the fowls and in order to check the spread of this disease the authors attempted vaccination of the birds with an attenuated virus prepared from material collected from affected cases according to the method described by MANTEUFELD. Markedly curative effects were obtained by the injection of this vaccine into animals already attacked. In most cases two injections were sufficient but in severe cases a third injection became necessary.

Preventive and curative vaccination was employed with 4,524 birds, of which 2,763 did not show any external symptoms of the disease but were fully exposed to contagion, and 1,761 or 58·94 per cent. were visibly infected. The mortality amounted to 373 cases or 8·24 per cent. of the total number treated, and 21·18 per cent. of the visibly affected fowls.

Unfortunately, in further attempts at vaccination the results were not so favourable. In two establishments containing 110 and 706 fowls, respectively, the vaccine provoked severe toxic and septic effects. These untoward results have led the authors to perform further experimental investigations on this question.

MIYAGAWA (Y.), TANIGUCHI (T.), NAGAO (S.) & TAKEMOTO (S.). **Cultivation of the Causal Organism of Contagious Anaemia of Horses.** — Contribution from Research Dept. for Infect. Dis. Imperial Univ., Tokyo. Dated June 30, 1918.

[From Review by R. G. MILLS.]

The organism of the above disease has hitherto been considered to be uncultivable and ultra-microscopic. In July 1917, Miyagawa and Takemoto found an organism, in the lymphatic glands, liver, and kidneys of a horse suffering from this disease. Subsequently, attempts were made to cultivate the organism and horses were inoculated with it to test its pathogenicity.

In Noguchi tubes cultures were obtained from the blood of sick horses, and the organism thus grown could be carried to the third generation and could produce the disease in healthy animals. It was found possible also to recover the organism from horses artificially infected in this way and transmit it from one animal to another. Infected animals became very anaemic and nucleated red cells appeared in their blood.

Direct transmission of the disease from one animal to another was possible when the blood used for inoculation was fresh, but it did not

succeed when the blood had been citrated and kept at body temperature in the incubator for 120 days. However, the virus that had been sub-cultivated for three generations in artificial media, covering a period of 130 days' incubation, was found capable of producing the infection.

Serum from a horse that had recovered from the (natural ?) infection was injected into another animal together with a culture of the organism ; very little protection was afforded against the latter owing to the presence of the serum. This result appears to be different from what would have been expected in the case of a bacterial infection.

Animals artificially infected were found to have the organisms distributed in the organs in the same way as in those spontaneously affected with the disease. Pfeiffer's phenomenon demonstrated very little spirochaetolytic power. Culturally the organisms grew in fluffy or spherical colonies in the middle of the tubes but no growth was seen at the upper end or at the bottom of the anaerobic tubes. The organism found in the circulating blood stains with Giemsa, but the cultivated organisms did not take on this stain. After partially decolourising, deeply stained granules are seen scattered within the body of the organism. These granules are also demonstrable by silver impregnation methods, carbol fuchsin, gentian violet, and after the employment of tannin as in Loeffler's stain for cilia. The organism is from 3 to 25μ in length and from 1/3rd to 1μ in diameter. The spiral turns are rather shallow and number from five to seven. The cultivated organism varies considerably in form and has a short terminal filament. Segmentation was both transverse and longitudinal. Motility was rather sluggish.

The name suggested for the organism is *Spirochaeta equi infectiosa.*

CURASSON (G.). **Le diagnostic de la péri-pneumonie dans la brousse.** [Diagnosis of Contagious Bovine Pleuro-pneumonia in the Jungle.] —*Bull. Soc. Cent. Méd. Vét.* 1918. Dec. 30. Vol. 94. No. 24. pp. 506–508.

In this article the author recounts difficulties in controlling the spread of bovine contagious pleuro-pneumonia in the French Sudan. This is comparatively easy in the case of the more or less highly domesticated animals belonging to natives leading a stationary existence but, on the other hand, the animals belonging to such nomad tribes as the Peulhs or Moors remain in a semi-savage state and it becomes impossible to fence them up within an enclosed area so as to enable one to resort to ordinary methods of diagnosis. Moreover, it is principally such animals which are instrumental in the dissemination of the disease. In addition, many animals affected with the disease escape the notice of a casual observer. In two herds belonging to Europeans and kept under careful observation 30 per cent. of the diseased animals were outwardly normal in appearance showing no lack of appetite, depression, or rough coat. The only symptom was an early morning cough which did not become accentuated on causing the animals to move on. On post-mortem examination all these animals showed recent localised lesions.

Another source of error is found in the case of herds in which an outbreak of rinderpest has occurred at some prior date. Many of the

animals remain in a poor condition for even a year afterwards but do not cough. If pleuro-pneumonia breaks out in such a herd these animals are generally slaughtered as suspects but no lesion is found on post-mortem examination. The only symptom that can be relied upon by a veterinarian who has to perform a considerable amount of work in the jungle is the cough. This is so well known to the natives that they immediately hide all animals that cough on the approach of the inspector. The following devices are recommended by the author for dealing with such herds. The Inspector makes a surprise examination of the animals in the early morning while they are parked or in the place where they have spent the night. As far as possible they are made to get up one by one and animals which show on rising a short abortive, exceptionally hacking, cough are immediately separated. The animals are then made to move on slowly in any direction and those which cough on starting to walk are also put aside. After about 200 to 300 yards the animals quicken their pace and those which lag behind, on account of their poor condition are placed with the sick animals; the cattle that bear old or sloughed lesions and do not always cough are eliminated in this way. After moving on for about 500 or 600 yards at a gradually increased pace the animals which remain in the body of the herd are regarded as having been simply in-contact, and these are vaccinated.

In the group of animals separated out one will thus find placed successively the seriously affected animals, animals recently infected, and then the carriers of old lesions. On post-mortem examination of a number of animals this classification was invariably confirmed. The method is admitted to be very coarse, but it is to such methods as these that one must have recourse in a colony like the French Sudan.

CASAGRANDI (O.). **L'antigeno per la prove della fissazione del complemento nell'infezione vaccinica vaiolasa.** [Antigen for Complement Fixation Test in Cowpox Infections.]—*Ann. Inst. Pasteur.* 1918. Oct. Vol. 32. No. 10. pp. 463–470.

In the complement fixation test as applied to variola or vaccinal infections great importance is attached to the method of preparation of the antigen. A good method consists in the utilisation of fresh vaccine separated from the glycerine, triturated without the use of silica and kaolin, and centrifuged in the presence of normal saline solution so as to obtain a slightly opalescent liquid. An antigen capable of furnishing more constant and reliable results is obtained from filtrates containing the virus alone and separated by the addition of sterile leucocytes. (If the leucocytes are examined by means of a dark-ground illumination they are seen to contain minute motile granules). A slightly opalescent emulsion in normal saline solution is then made from the deposit of leucocytes. This antigen has the following advantages:—(1) It consists of pure virus distributed in cellular elements and contains no living organisms which might lead to rapid contamination. (2) It contains the living and virulent virus as can be readily demonstrated by the inoculation on to the skin or cornea of a rabbit. (3) Controls can be employed by the use of antigen made of the above leucocytary material without the presence of the virus.

MISCELLANEOUS.

SERGENT (Edm. & Et.) & LHÉRITIER (A.). **Fièvre bilieuse hémoglobinurique du bœuf d'Algérie, maladie distincte des piroplasmoses.** [Haemoglobinuric Biliary Fever of the Ox in Algeria,—a Disease Not Identifiable with the Piroplasmoses.]—*Bull. Soc. Path. Exot.*, 1919. Feb. Vol. 12. No. 2. pp. 108–120.

Among the most important diseases which hinder stockbreeding in Northern Africa is placed a bovine affection commonly known locally as the "yellows." The cardinal symptoms of the disease are jaundice haemoglobinuria, and fever. In cases terminating fatally the disease seldom lasts more than five or six days; sometimes the animal succumbs in 24 hours. According to the veterinary inspectors and colonials the losses caused by the disease are very high. In outbreaks observed by the authors the figures were as follows: in the winter of 1915–1916 at Flatters, out of 258 oxen, 30 diseased, 13 dead (5 per cent.); at Smendou, losses of 20 per cent. among a herd; at Robertville losses of 12 per cent.; in December 1917, at Habra, a disease incidence of 10 per cent., mortality of 5 per cent.

Inasmuch as the principal features of the disease are identical with those of piroplasmosis and *Piroplasma bigeminum* is known to exist in Algeria these cases of jaundice are generally considered to be cases of piroplasmosis. However, at the commencement of their investigation into this disease a certain number of paradoxial facts became manifest which caused the authors to doubt the constancy of piroplasms as etiological factors in the disease. A minute study was thus made of 11 cases of jaundice, involving a careful microscopic examination of the blood and organs for the presence of piroplasms or other parasitic structures such as have been hitherto described (KOCH'S bodies of East Coast fever, or BLIER'S bodies regarded as Sergentella in a disease of cattle in Chili). The number of parasites found in proportion to every 1,000 red corpuscles was estimated and comparisons were made of the blood invasions in various animals from these figures. Secondly, an attempt at experimental reproduction of the disease was made by the inoculation of blood or diseased organs into healthy animals. Further, similar examinations were made on a large number of animals in apparent health and comparisons instituted between the data furnished.

Out of the above 11 cases of disease one only could be attributed to an infection with *P. bigeminum*. The remaining 10 cases did not show this particular piroplasm but only small ring-shaped or bacillary piroplasms; anaplasms were also seen. The small ring-shaped or rod-like piroplasms were found to be as numerous in the blood of animals in apparent health as in that of affected ones and they did not undergo any increase in number during the course of the disease. Blood and material from the organs of four of the diseased animals taken at the 2nd, 4th, 5th, 6th, and 12th days of the disease were inoculated into healthy animals obtained from a region in which the disease had not been recognised; no increase in number of the parasites in the blood of the latter animals was subsequently observed.

The small ring or rod-shaped bodies might be identical with either *Theileria parva* or *P. mutans*. However, the former of these parasites can be ruled out of count inasmuch as (1) the symptoms of East Coast fever caused by *Th. parva* differ essentially from the Algerian disease inasmuch as two of the cardinal symptoms are wanting, viz., the redwater and the jaundice; (2) the parasites in the peripheral blood are as rare in the case of the diseased animals as in the case of healthy controls in the Algerian disease; (3) Koch's bodies, characteristic of East Coast fever were always found to be extremely rare in the glands and they were also extremely rare in the controls; and, (4) inoculation of gland pulp from diseased animals into healthy cattle did not provoke any change in the blood in the case of the Algerian disease whereas East Coast fever can be transmitted by this method.

Piroplasma mutans does not play any important part in this disease inasmuch as in the ten cases observed (1) the parasites were not more numerous in the blood than in the case of the controls, did not undergo change in number during the course of the disease, and did not appear to be more numerous in animals inoculated with the blood or organs of the diseased subjects, (2) the disease is not transmissible by blood inoculation as is the case in infections due to *P. mutans*.

The authors thus consider that the Algerian affection is a disease which is different from the piroplasmoses and propose to designate it, while its etiology is unknown, as "bovine biliary haemoglobinuric fever." Various hypotheses are suggested in connection with its etiology.

SERGENT (Edm.) & LHÉRITER (A.). **Note sur la température rectale des Dromedaires.** [The Rectal Temperature of Dromedaries.]—*C. R. Soc. Biol.* 1919. Feb. 22. Vol. 82. No. 4. pp. 172–175. With 5 charts.

A number of researches were made by the authors at Algiers in order to ascertain the causes of the very considerable variations occurring in the rectal temperature of dromedaries. From the results of this work they conclude that the rectal temperature of dromedaries is one of the lowest among those of mammals, average 37° C. (98·4° F.). It is subject to striking variations; the most sudden and considerable depressions are brought about when the dromedaries are exposed to rain. The lowering in temperature of these animals caused by the rain is not attributable to the general cooling of the atmosphere brought about by the atmospheric changes but it is particularly to the effects of wetting that the dromedaries are especially sensitive.

SINCLAIR (J. M.). **Wastage of Dip in Dipping Operations.**—*Rhodesia Agric. Jl.*, 1919. Feb. Vol. 16. No. 1. p. 24.

"Owing to the high cost of cattle dip, the conservation of fluid by the use of adequate draining pens is a matter of pounds, shillings and pence, and, as it will probably be a long time before prices come down to pre-war rates, tank owners would be well advised to consider the

draining arrangements at their tanks with a view to reducing wastage to a minimum.

"The following observations made by the Department shew that proper draining accomodation means a saving of many pounds per annum :—

Tank.	Drainage.	No. of cattle.	Wastage in gallons.
1	Large single pen ..	1,250	480
2	Double pen	680	200
3	Race 34 feet.. ..	603	300
4	Race 30 feet.. ..	1,004	720
5	Race 60 feet.. ..	1,200	400
6	Race 60 feet.. ..	1,643	385
7	Race 72 feet.. ..	1,650	290
8	Race 72 feet.. ..	1,635	300

"In considering these quantities, the size of the cattle must be taken into consideration. At tanks Nos. 1, 3 and 4, which are on or adjoining Salisbury commonage, dairy cattle predominate, and the number of small animals, i.e., calves, yearlings, and two year-olds, will therefore be greater than in the average herd of farm cattle. The cattle at No. 2 tank are highly graded throughout, and the average size is considerably larger than in the average herd of farm cattle. At tanks Nos. 5 to 8 inclusive the animals are of the small Mashona type. The double draining pen and the long draining races are very economical; in the latter the wastage is governed largely by the speed at which the cattle are driven through. The single draining pen can be made as economical as any other plan, but only by a considerable wastage of time."

CROSS (H. E.). **Are Camels Susceptible to Blackquarter, Haemorrhagic Septicaemia and Rinderpest?**—*Agric. Res. Inst., Pusa, Bulletin No. 80.* 1918. 17 pp. with 1 plate and 16 charts. 1919. Calcutta: Supt. Govt. Ptg., India. [Price, As.4 or 5*d.*]

Blackquarter. Although outbreaks of blackquarter similar to those occurring among cattle have not been reported in camels, deaths from this disease are occasionally stated to take place. In order to determine the susceptibility of camels to the disease three camels (two one-year olds and one seven-years old) were inoculated intramuscularly with blackquarter virus, one young buffalo and one young calf acting as controls.

The first symptom noticed in the inoculated camels was a rise of temperature followed by a suspension of rumination and loss of appetite. The animals then showed a disinclination to stand and were lame on being forced to move. A swelling then soon appeared around the seat of inoculation which rapidly increased in size and became emphysematous. Breathing became difficult, the camel then lay on its side and was unable to get up. The temperature fell rapidly just before death, which took place in 37½ and 38½ hours in the yearling camels and in 63½ hours after inoculation in the seven year old camel. The control buffalo died after 23½ and the calf after 45½ hours.

On post-mortem examination the only lesion found was a large emphysematous swelling at the seat of inoculation. The muscles of this part were of a dark brown to a black colour and of a slightly rancid odour.

From these results the author concludes that "camels are as susceptible to blackquarter as cattle." [These results, however, appear to be entirely illusory inasmuch as they only demonstrate the susceptibility of camels towards artificial inoculation with the blackquarter organism, but do not necessarily throw light on the susceptibility of these animals towards natural attacks. Guinea-pigs, for example, can be killed with certainty by experimental inoculation with small quantities of virus although the natural disease in these animals is unknown. Also, the immunity of adult cattle towards the natural affection is very great, whereas by experimental inoculation the author succeeded in killing a seven year old camel.—ED.]

Haemorrhagic septicaemia. In India the losses among cattle from this disease are very considerable but it is not known whether it may be the cause of death in camels.

The author inoculated subcutaneously two camels with an artificial culture of the haemorrhagic septicaemia organism and simultaneously two calves and two rabbits as controls. In the case of one of the camels, a male, one year old, the temperature rose to 104·8° F. ten hours after the inoculation. A slight swelling, hot and painful, appeared in 34 hours at the seat of inoculation but the appetite was maintained throughout and the temperature became normal 74 hours after inoculation. The other camel—a male seven years old—showed a very slight rise in temperature 34 hours after the inoculation, and a slight swelling appeared at the seat of inoculation which disappeared after two days; the camel fed well throughout the experiment. Death was rapidly produced in the control animals inoculated.

The author then quotes GAIGER's experiments in this connection and concludes from the information thus gained that "camels are not very susceptible to haemorrhagic septicaemia."

Rinderpest. Although outbreaks of this disease are stated not to occur amongst camels deaths from it are occasionally reported but no reliable information on this point is available.

Three camels (one one-year old, one six-year old, and one 12-year old) were inoculated subcutaneously with 5 c.c. of virulent rinderpest blood, two calves, 11 months old, being inoculated simultaneously as controls. The one-year old and six-year old camels are stated to have developed typical symptoms of rinderpest. The latter after an incubation period of seven days showed a rise of temperature, inappetence, vesicles on the lips and tongue, and diarrhoeic faeces which became blood-tinged in three days; the symptoms then abated; the faeces became normal in eight days after the onset of the disease and the buccal lesions healed in ten days. In the case of the former camel the symptoms were of the same nature but somewhat less pronounced. In the case of the third (the 12 year old camel) mild symptoms of the same kind were also observed. The two calves which acted as controls showed only a temperature reaction and loss of appetite.

"The only conclusions to be drawn from the above are that camels develop severe lesions of rinderpest and are more susceptible than some cattle to rinderpest." The results are stated to confirm the observations of PETROWSKY (Wiedornikow) on Steppe camels.

BÉDEL. **Aphticelle des bovidés.** [Bovine Aphticella (a Disease simulating Foot-and-Mouth Disease).]—*Rev. Gén. Méd. Vét.* 1919. Jan. 15. Vol. 28. No. 325. pp. 12–17.

Under the above title the author describes a disease of an undetermined character observed among cattle evacuated from Northern France in April and May 1918. This disease did not appear to be foot-and-mouth disease or cow pox but a condition analogous to that described as pseudo-foot-and-mouth disease by Danish veterinarians (BANG, STRIBOLT, and ANDERSEN). It differed from the last named condition, however, in that no tumefaction of the limbs around the region of the cannon bone or serous exudate in this region could be observed.

It differed from foot-and-mouth disease in the following respects. The rectal temperature was very little elevated—38·8° to 39·5° C. There was very little salivation. The buccal vesicles, which were rounded or oval and not analogous to those produced as the result of a burn, showed (1) a central rounded brownish point, (2) a circular or oval yellowish-white zone formed by a very slight raising of the epithelium by a scarcely perceptible exudate; some vesicles were distinctly umbilicated. There were no vesicles on the upper surface of the tongue; the epithelium covering each vesicle became desquamated leaving a reddish-eroded patch the circumference of which was not clearly marked off from the surrounding epithelium, while frequently towards its centre there was a small opening about the size of a pin's head.

VELU (H.). **Une affection non décrite du chien observée au Maroc.** [An Undescribed Affection of the Dog observed in Morocco.]—*Bull. Soc. Path. Exot.* 1919. Mar. 12. Vol. 12. No. 3. pp. 132–134. With 1 plate comprising 5 figs.

In this note the author describes a disease which manifested itself as a severe enzootic during the months of August and September of 1918 in a district situated about 40 kilometres from Casablanca. It is recalled that HECKENROTH (F.) [see this *Bulletin*, 1918, Vol. 6, No. 4, p. 250] described a similar disease of the dog in Senegal. Clinically the disease resembled rabies very closely and nervous symptoms were always predominant. These consisted in locomotory derangements affecting especially the hind quarters, loss of equilibrium, and grinding movements of the jaws; paraplegia and then complete paralysis set in in a few days. A few days after the first symptoms are shown rhinitis, a cough of a whooping character, and then intense dyspnoea may be seen. The appetite remains normal but the affected animals always vomit after a meal, and loss of condition is very rapid. As a rule death occurs in from 8–10 days after the onset of symptoms but a few cases may recover. No lesion is seen post-mortem. A few attempts at transmission of the disease to susceptible dogs by cohabitation, or inoculation of blood or brain material, failed. The rabbit was also found to be resistant.

MARSH (C. Dwight) & CLAWSON (A. B.). **White Snakeroot or Richweed (*Eupatorium urticaefolium*) as a Stock-Poisoning Plant.**—i. *U.S. Dept. Agric., Bureau of Animal Industry.* 1918. Feb. 28. 7 pp. With 1 text-fig. 1918. Washington: Govt. Ptg. Office. ii. *Jl. Agric. Res.*, 1917. Dec. 24. Vol. 11. No. 13. pp. 699–715. With 4 plates comprising 7 figs.

Among the suggested causes for the disease popularly known as milk sickness, trembles, tires, etc., in certain parts of the United States of America has been the plant commonly known as white snakeroot. This is a slender erect perennial herb belonging to the family Compositae, flowering in the late summer and autumn. Its leaves which are 3 to 5 inches long, are opposite, broadly ovate, pointed, sharply-toothed and thin, and have rather long petioles; the stems are viscid-villous, the small white flowers in compound corymbs of 8 to 10 flowers.

The most noticeable and typical symptom of the disease in animals fed with this plant is trembling, which is seen especially in the muscles about the knees and in those of the legs. This becomes marked after exercise and may cause the animal to fall to the ground. In some cases trembling is the first symptom noted but in others there is a preceding period of marked depression and inactivity. In most cases there is constipation and some have bloody faeces. Nausea and vomiting are set up by excessive feeding. Respiration is normal except during exertion. The temperature is normal, weakness is very pronounced, sometimes the animal lives several days after the appearance of the first symptoms. On post-mortem examination the small intestine is found to be congested and the liver abnormal.

The authors' experiments were performed on cattle and sheep but feeding experiments carried out by other workers have proved the toxicity of the plant for horses, and extracts have poisoned cats. dogs, and guinea-pigs. The fatal dose for a sheep is about six per cent. of its body weight and for cattle about 10 per cent. There is very little difference between the toxic and lethal doses as determined by experiment. Elimination of the toxic substance appears to take place very slowly so that there is a distinct cumulative effect. Poisoning by Eupatorium is produced by a poisonous principle in the plant and not by disease germs carried by the plant to animals.

Under the term milk sickness or trembles, the authors believe two distinct diseases at least are included, viz., poisoning by the above plant and a bacterial disease to which both animals and man are susceptible.

[The above work is extracted on account of the fact that the condition which is known as trembles in sub-tropical or tropical countries may be analogous in character.—ED.]

REPORT.

UGANDA PROTECTORATE. **Annual Report Department of Agriculture for the year ended 31st March 1918.**—Report of the Chief Veterinary Officer [HUTCHINS, E.]. pp. 36–41 f'cap. 1918. Entebbe: Govt. Ptr.

Diseases of cattle.—Rinderpest. No outbreaks of this disease occurred in the Buganda and Western Provinces during the year. In October, in view of the spread of rinderpest in Bunyoro, all the cattle in Uganda within 20 miles of the boundary of Bunyoro were moved southwards.

In the Eastern Province numerous outbreaks occurred in the Bukedi and Busoga districts and small outbreaks in the Teso district. All transport cattle in Teso and Bukedi were actively immunised. Deaths during the reaction were negligible. Bullock transport in these districts was therefore carried on without interruption during the year. The disease was re-introduced into Lango in June from the Northern Provinces and soon became extremely widespread throughout the district and caused great losses. The outbreak died out by the end of December. This outbreak upon investigation was traced to the importation of some undried hides by an Indian trader from the Gulu district. Rinderpest was found to have been introduced into Bunyoro from Atura through the medium of game. 2,020 cattle were doubly-inoculated in the Bukedi and Teso districts.

In the Northern Province no outbreaks of rinderpest occurred in the West Nile district but the disease was prevalent in April, May and June in the districts of Gulu and Chue. Early in July buffaloes were dying near Pynodni near the west bank of the Nile and the infection spread southwards, causing the death of large numbers of game animals, along the Kafu Valley. Up to the end of March the epizootic in Bunyoro was confined to the game in the tsetse fly areas. The disease also spead in a westerly direction and appeared amongst the game on the shore of Lake Albert near Butiaba in 1918. The question as to whether rinderpest in game causes any diminution in the numbers of *G. morsitans* is being investigated by H. L. DUKE.

Trypanosomiasis. Deaths among cattle in the Mengo districts were not quite so heavy as in past years, but outbreaks set up by *T. pecorum* are mentioned both in this district and in the Masake district. Tabanidae, especially *T. africanus*, were found to be extremely numerous in the latter district around roads along which transport oxen travelled and the infection appears to have been spread mainly by these flies. Several cases were also detected in cattle brought from the Mubendi district for sale in Kampala. Losses were also noted in Toro, where *G. fusca* appears to have been the vector of *T. pecorum*, Ankole, and Bunyoro. The majority of the cattle in the eastern half of the Kafu Valley were reported to have died from trypanosomiasis during the past three years.

49 cattle infected with *T. pecorum* were treated; of these 23 died, 10 recovered, and 16 were under treatment at the end of the year. Twelve cattle infected with *T. vivax* were treated. Of these four died, seven recovered, and one remained under treatment. A case of recovery in a cow infected with *T. pecorum* is described; the treatment consisting of subcutaneous injections of soamin in 5 gramme

doses for a period of five months. No ill-effects were experienced by people who consumed the milk from this cow. An experiment was made to ascertain whether the virulence of *T. pecorum* for cattle could be reduced by passage through goats but the results were negative.

In Kampala observations tended to show that *Stomoxys calcitrans* was mostly concerned in spreading *T. pecorum* and *T. vivax* from infected to healthy cattle. Measures were taken in order to reduce the numbers of these flies in the district. A new tsetse fly area was found in Buruli extending from Nakikoma as far as Bumoni in Butengeza. A new *morsitans* area was also found in Bunyoro near the Waki River. In Ankole *G. morsitans* is reported to be spreading northwards towards Mbarara on the Massa Plains. In the West Nile district this fly was also found to be very numerous in the Bush country from Mutir as far as the Escarpment.

East Coast Fever. Some deaths from this disease occurred amongst transport oxen working between Soroti and Lali. In the Teso district the disease is not uniformly enzootic. In the Kegezi district it appears to be enzootic, but it does not exist in the West Nile district. A cattle dipping tank is being constructed at Kampala.

Several deaths from anaplasmosis occurred amongst cattle in Kampala; these were probably due to relapses caused by "fly worry" from Stomoxys.

Foot-and-mouth disease was prevalent from June to August on the Mbarara-Masaka Road and cases were found amongst horses in the Kigezi district in September. Mild outbreaks occurred in Entebbe, Bulemezi and Singo. An outbreak was also reported in the South-Eastern Division of the Bukedi district in November.

Several cases of tuberculosis were diagnosed at the Kabete laboratories amongst cattle sent from Ankole for the production of anti-rinderpest serum. The first confirmed case of the disease in Uganda is reported among one of the Kampala municipal oxen.

One case of malignant catarrhal fever occurred in Kampala. The symptoms bore some resemblance to those of rinderpest but blood taken from this case and inoculated into a bullock susceptible to rinderpest caused no reaction. Several cases of ulcerative stomatitis were noted amongst calves in Kampala. At this place also an outbreak of dermatitis occurred in a dairy herd. The skin lesions were very numerous and appeared in the form of circular necrotic areas. A streptothrix organism was found in smears from this lesion.

Diseases of equines.—Six cases of ulcerative lymphangitis in mules were reported; five of these were treated with vaccine and two were cured. No cases of epizootic lymphangitis were reported.

Diseases of sheep and goats.—Heavy losses among goats from scabies were reported in the Masaka district. Since 1916 in North East Bugishu nearly four-fifths of the goats have died from this disease. Sheep do not appear to have been affected. The disease is known to the natives as *kakwiyea* (scab) and appears to have been complicated with goat pox. Goat scab has been very widespread in the Teso district also in recent years.

Diseases of dogs.—34 cases of piroplasmosis were treated in Kampala. In the North Eastern Bugishu Division a disease was reported to have killed off native dogs and jackals but the symptoms were not,

as far as could be ascertained, similar to those of rabies. A number of statistical returns are then given.

The most formidable disease of the Protectorate appears to be rinderpest. The report thus concludes with the following observations.

"During the past year rinderpest did not cause severe losses amongst cattle in the districts of Lango and Bukedi, but the introduction of this disease into the game in Bunyoro will lead to very heavy losses in the Western and Buganda Provinces.

"These Provinces contain hundreds of thousands of cattle which are very highly susceptible to rinderpest and, unlike the Eastern Provinces, where cattle are scarce, game is numerous. Throughout these areas rinderpest must be expected to spread rapidly and to work its way through the game into Ankole and thence to Ruanda and the Congo."

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[Continued from this *Bulletin*, Vol. 6, No 4, pp. 265–273].

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